Apple II From Apple IIe to Apple IIGS™
Performance Update

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Contents

Figures and tables

Radio and television interference

The equipment described in this manual generates and uses radio-frequency energy. If it is not installed and used properly—that is, in strict accordance with our instructions—it may cause interference with radio and television reception.

This equipment has been tested and complies with the limits for a Class B computing device in accordance with the specifications in Subpart J, Part 15, of FCC rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that the interference will not occur in a particular installation, especially if a "rabbit-ear" television antenna is used. (A rabbit-ear antenna is the telescoping-rod type usually found on television receivers.)

You can determine whether your computer is causing interference by turning it off. If the interference stops, it was probably caused by the computer or its peripheral devices. To further isolate the problem, disconnect the peripheral devices and their input/output cables one at a time. If the interference stops, it was caused by either the peripheral device or the I/O cable. These devices usually require shielded I/O cables. For Apple peripherals, you can obtain the proper **shielded cable** from your dealer. For non-Apple peripheral devices, contact the manufacturer or dealer for assistance.

A shielded cable has a metallic wrap around the wires to reduce the potential effects of radio-frequency interference.

Important   Your Apple computer and its peripheral devices were FCC-certified under test conditions that included use of shielded cables and connectors between system components. It is important that you use shielded cables and connectors to reduce the possibility of causing interference to radio, television, and other electronic devices.

If your computer does cause interference to radio or television reception, you can try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the computer to one side or the other of the television or radio.
- Move the computer farther away from the television or radio.
- Plug the computer into an outlet that is on a different circuit than the television or radio. (That is, make certain the computer and the radio or television set are on circuits controlled by different circuit breakers or fuses.)
- Consider installing a rooftop television antenna with a coaxial cable lead-in between the antenna and television.

If necessary, consult your authorized Apple dealer or an experienced radio/television technician for additional suggestions.

Chapter 1

What's New?

You already know how to use the Apple® IIe, so this book is about the features that distinguish the Apple IIGS™ from the Apple IIe and about the new mouse-based interface that will be common to many of the new applications developed or adapted for the Apple IIGS.

Here's a breakdown of the book chapter by chapter:

- Chapter 1 describes the features that distinguish the Apple IIGS from the Apple IIe.

- Chapter 2 explains new things you need to know about connecting peripheral devices to the Apple IIGS.

- Chapter 3 explains how to use the Apple IIGS's built-in Control Panel Program to customize your computer system.

- Chapter 4 tells you what to expect from mouse-based applications—applications that use built-in programming tools to make applications easier to learn and more intuitive to use. You'll also learn about the DeskTop, a mouse-based utility application and program selector that lets you switch quickly from one application to another.

- Appendix A is a troubleshooting guide.

- Appendix B describes the differences between the Apple IIGS and other models of the Apple II in more technical terms. If you write applications as well as use them, you might want to go directly to Appendix B.

- Appendix C shows pin-outs for the ports on the back panel.

Before you start up

If you've got deadlines to meet and ongoing work that doesn't permit you the luxury of exploring all the new features of the Apple IIGS right now, go ahead and start using it. You can connect peripheral devices and use applications in much the same way you did on your Apple IIe with a couple of provisions:

- When you install an interface card in a slot on the Apple IIGS, you need to *activate* the slot before the Apple IIGS will know there's a card in it. You do this by using the Control Panel Program, which is explained in Chapter 3. It's a simple procedure, and once you activate a slot, it stays active. The reason it's necessary is that each port on the back of the Apple IIGS is designed to impersonate a particular slot with an interface card. (This is so applications that look for devices connected to slots will also be able to find devices connected to ports.) You can't have both a port and its corresponding slot active at the same time. You activate one or the other by using the Control Panel Program.

- If you have both a 5.25-inch disk drive and a 3.5-inch disk drive connected to your Apple IIGS, the computer will try to start up from the 5.25-inch drive. If you want to start up from the 3.5-inch drive, read "Changing the Startup Drive" in Chapter 3.

- If you had a UniDisk™ 3.5-inch drive connected to a disk drive controller card in your Apple IIe, you must connect it to the disk drive port on the Apple IIGS in order for the computer to access it.

- Cards designed for the Apple IIe's AUX. CONNECTOR slot can't be installed in any of the slots on the Apple IIGS circuit board. Most of the features you got by adding a card to the AUX. CONNECTOR slot (an 80-column display, additional memory) are built into the Apple IIGS, so this shouldn't be a problem.

- The Apple IIGS's microprocessor can operate at two speeds: 1 MHz (megahertz) and 2.8 MHz. The standard speed for the Apple IIe is 1 MHz. The standard operating speed for the Apple IIGS is 2.8 MHz. The Apple IIGS will run all programs at the faster speed—even programs developed for earlier models of the Apple II. Most of the time, faster is better; but if the faster speed throws off the timing of applications or keeps them from running properly, you can change to 1 MHz by using the Control Panel Program, explained in Chapter 3.

Features

Here are some of the features that distinguish the Apple IIGS from the Apple IIe:

- 65C816 microprocessor; a 16-bit processor with a processing speed up to three times faster than the 8-bit processor in the Apple IIe.

- 256K RAM standard.

- 128K ROM including Applesoft BASIC.

- Super-high-resolution graphics (640 by 200 dots using 4 colors; 320 by 200 dots using 16 colors). Supports all other Apple II graphics modes (low resolution, high resolution, double-high resolution).

- Tools in ROM for developing programs that use icons, pull-down menus, and other components of mouse-based, Macintosh-like applications. You may not use these tools to develop applications yourself, but the fact that they're in ROM means that lots of mouse-based applications will be developed for the Apple IIGS and you'll be able to use them.

- Built-in clock, so documents can be marked with the date and time you created or revised them.

- Ability to set the built-in clock, customize the look of the display, and alter the feel of the computer system by using the Control Panel Program in ROM.

- Ability to use desk accessories—miniature applications like a notepad, a calculator, a clock—without leaving your main application.

- Built-in 80-column capability, so you don't need to add a special interface card to get an 80-column display.

- Choice of color for text, background, and border of display by using the Control Panel Program.

- High-quality sound. By using software designed for the purpose, you can get your system to generate 15-voice sound and even speech.

■ Built-in support for standard peripheral devices through ports on the back panel, so you can add up to four disk drives (either 3.5-inch drives or 5.25-inch drives), a printer, a modem, a mouse, a monochrome monitor, an analog RGB color monitor, and connect to an AppleTalk™ Personal Network without using interface cards.

■ Memory expansion slot. By putting a special memory card in the memory expansion slot, you can add from 1 to 8 megabytes of RAM to your Apple IIGS. New applications will use the extra memory on the card as an extension of the built-in RAM. You can also use the memory on the card as a RAM disk.

The best thing about these new features is that they are implemented in such a way that you can go on using most of the Apple IIe programs and peripheral devices you already have.

General-purpose slots

ROM (128K) includes Applesoft
BASIC and Control Panel Program

65C816 microprocessor

RAM (256K)

Memory expansion slot
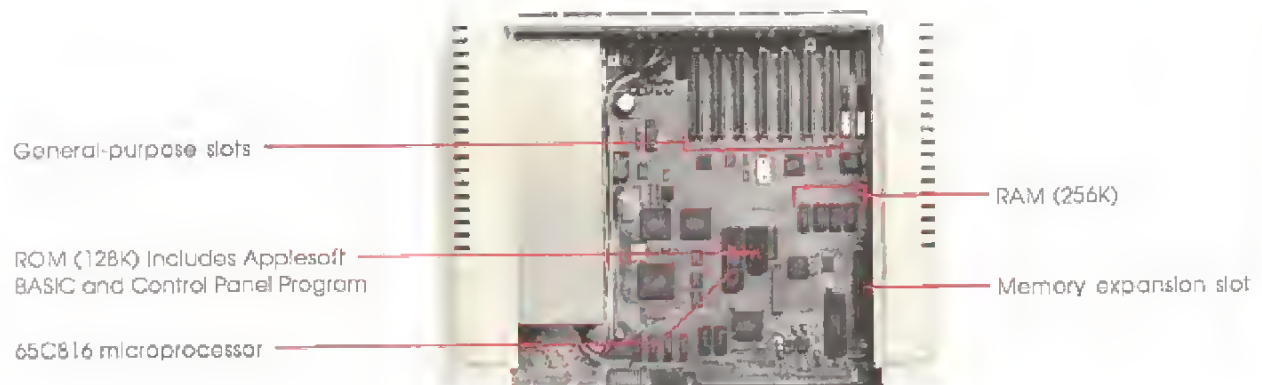
Figure 1-1
Main circuit board

❖ *Note:* The screws packed with your Apple IIGS are for securing the lid of the computer to the case.
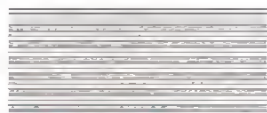
Chapter 2

Making Connections

There are two ways to connect peripheral devices to your Apple IIGS: by using the ports on the back panel, or by using the slots on the main circuit board. The advantage of using ports is that it's easy—just run a cable from the device to the computer. The advantage of using slots is that you can connect a wide variety of devices to the computer. You aren't limited to the devices for which there are ports.

Incidentally, some of the devices that you connected to the Apple IIe with an interface card (serial printers, modems, disk drives) can be connected directly to ports on the Apple IIGS. To do this, you may need to get a cable designed for the port on the back panel. You may not be able to use the cable that plugged into the interface card. If you don't want to bother getting a new cable, go on using your interface card. It's up to you.

Important	There are a few types of interface cards that you may not be able to use with the Apple IIgs. These potentially incompatible cards include accelerators, multifunction cards, certain 80-column text cards, and all cards designed for the AUX. CONNECTOR slot on the Apple IIe. If you have any questions, ask your authorized Apple dealer.

Slots

There are seven general-purpose slots on the main circuit board of the Apple IIGS. (See Figure 2-1.)
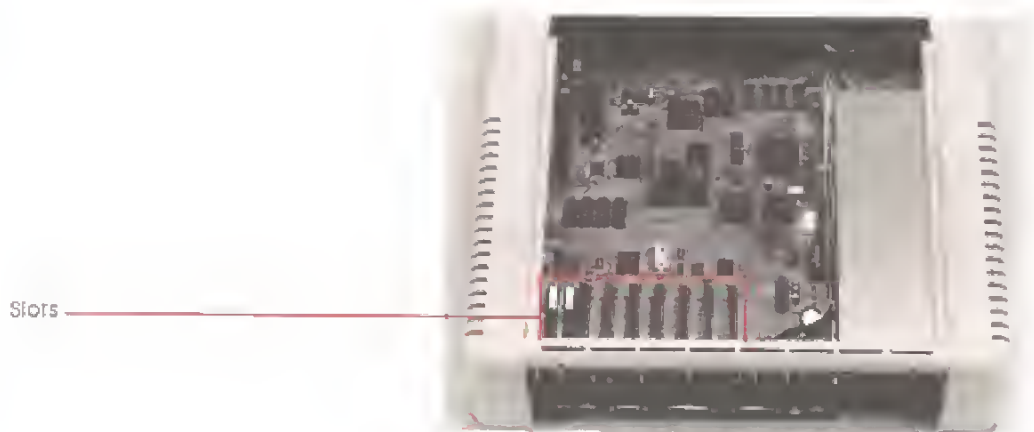
Slots

Figure 2-1
Slots

They serve the same purpose and work the same way as the slots on the Apple.IIe—or, they *will* work the same way as soon as you activate them. The reason it's necessary to activate slots is that each port on the back of the Apple IIGS impersonates a particular slot with an interface card. (This is so programs that look for devices connected to slots will also be able to find devices connected to ports.) The Apple IIGS assumes you want the ports to be active unless you activate a particular slot by using the Control Panel Program, explained in Chapter 3.

Important	If you install more than three interface cards, you should also install a fan to keep your system from overheating. Fans are available from your authorized Apple dealer.

Table 2-1 shows you which port or built-in function corresponds to which slot so you know what you're deactivating when you activate a particular slot.

Table 2-1
Slots and ports

Device	Connected to	Looks like a card in
Printer	Printer port	Slot 1
Modem	Modem port	Slot 2
80-column support	In ROM	Slot 3
Mouse	Apple Desktop Bus™	Slot 4
3.5-inch drive	Disk drive port	Slot 5
5.25-inch drive	Disk drive port	Slot 6
AppleTalk	Printer or modem port	Slot 7

Startup slot

When you turn on the Apple IIGS, the first thing the computer does is check its slots (or corresponding ports) for a startup device. It looks first in slot 7, the highest-numbered slot. If it doesn't find a startup device there, it looks in slot 6, the next-highest-numbered slot, and so on until it finds a disk drive of some sort. This method of looking for a startup device is called *scanning*. Your Apple IIe did the same thing before it got its board-lift.

But with the Apple IIGS, scanning is just one of your startup options. If you don't want the computer to start up from the device in the highest-numbered slot, you can designate a particular slot as the startup slot by using the Control Panel Program, explained in Chapter 3.

Memory expansion slot

The memory expansion slot is for adding a memory expansion card to the Apple IIGS. By adding a memory expansion card, you can increase the memory in increments of 256K by 1 to 8 megabytes.

Do not confuse the Apple IIGS's memory expansion slot with the Apple IIe's AUX. CONNECTOR slot. The AUX. CONNECTOR slot is for adding 80-column capability, additional RAM, and RGB color capability to the Apple IIe. Those features are built into the Apple IIGS, so you don't need the slot or the card you had plugged into it.

Slot 3

As with your Apple IIe, you shouldn't put an interface card in slot 3 unless the instructions that came with the card specifically say it's OK. Slot 3 was the 80-column card slot in earlier models of the Apple II, and for purposes of software compatibility, a card in slot 3 may interfere with the Apple IIGS's built-in 80-column capability.

Ports

Figure 2-2 gives you an overview of which device goes with which port.

Printer
Modem
Stereo headphones
Joystick or hand controls
Disk drive

Analog RGB color monitor

Monochrome monitor

Mouse and other Apple Desktop Bus devices
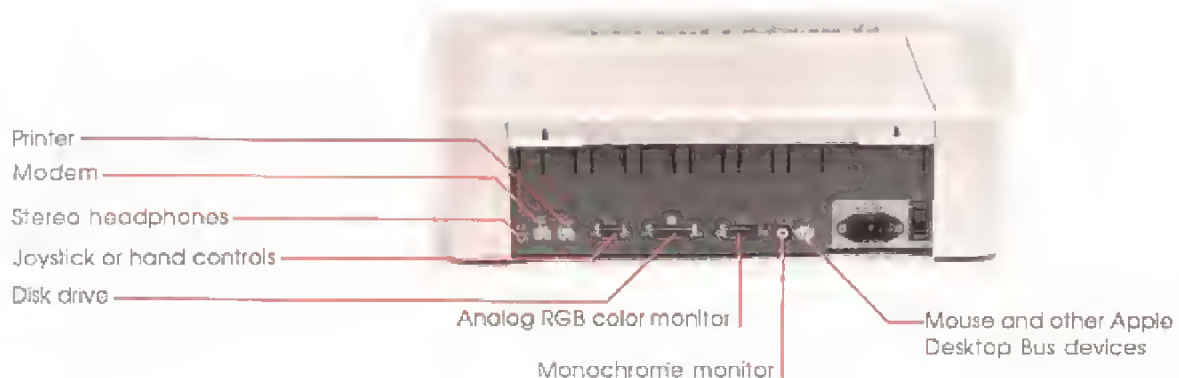
Figure 2-2
Ports

Most of the ports on the back of your Apple IIGS are designed for a particular type of peripheral device (stereo headphones, a joystick, disk drives, a monochrome monitor or an NTSC composite color monitor, an RGB color monitor, a mouse, or some other Apple Desktop Bus™ device). The exceptions are the printer and modem ports. These are general-purpose serial ports, and you can change their configuration so that the computer can communicate with a wide variety of serial devices.

You change the configuration of the serial ports by using the Control Panel Program. This is analogous to changing the switch settings on a serial interface card.

Printer port

The printer port is set up to work with the Apple Imagewriter, the Apple ImageWriter™ II, and many other serial printers. If your serial device requires a different configuration—if it doesn't work when you plug it in and try to print something—you can change the characteristics of the port by using the Control Panel Program, explained in Chapter 3.

Modem port

The modem port is set up for exchanging information with most popular information services. The baud is set to 1200, but you can easily change that and other characteristics of the port by using the Control Panel Program, explained in Chapter 3.

Important   Some communications programs that work with a serial interface card, like the Apple Super Serial Card™, won't work with modems connected to the Apple IIGS modem port. These programs address a particular chip on the serial interface card called the ACIA. The serial interface that's built into the Apple IIGS performs the same functions as the card, but doesn't use the same hardware, so applications that address the hardware directly won't work if your modem is connected to the port. If you have such an application, your alternative is to get an application designed to work with the serial interface built into the Apple IIGS or to go on using your serial interface card.

Disk drive port

You can connect up to four disk drives to the Apple IIGS through the disk drive port. The first drive plugs into the port, and the others plug into each other in a daisy chain. You can connect both 3.5-inch and 5.25-inch drives in one daisy chain, but only two of either type, and the 3.5-inch drives must be connected closest to the computer in the daisy chain.

If you have both 5.25-inch drives and 3.5-inch drives connected to the port, the computer will try to start up from the 5.25-inch drive (which looks to the computer as if it's connected to slot 6). If you want to start up from a disk in your 3.5-inch drive (which looks to the computer as if it's connected to slot 5), make sure the 5.25-inch drive is empty. When the computer can't find a disk in the 5.25-inch drive, it will check the 3.5-inch drive next.

❖ *Note:* This works only with drives connected in a daisy chain. If your drive is empty and it's connected to a disk controller card, you'll get the message CHECK STARTUP DEVICE.

Depending on whether the majority of your applications are on 3.5-inch or 5.25-inch disks, you might want to use the Control Panel Program, explained in Chapter 3, to change the startup drive.

Game port

The game port is identical to the game port on the Apple IIe. Use it to connect a joystick or a pair of hand controls.

Important | Don't use the game port to connect a mouse! If you have an Apple IIe mouse, you should connect it by using the mouse interface card, as you did on your Apple IIe. If you have a mouse designed for the Apple IIGS, you should connect it to the Apple Desktop Bus.

Apple Desktop Bus

The Apple Desktop Bus is for connecting an Apple IIGS mouse and other Apple Desktop Bus devices. It's called a *bus* instead of a *port* because several devices can "ride" one connector. It's called a *desktop* bus because the only thing desktop devices have in common is that they all fit on the desktop. Devices that use this bus will be labeled *Apple Desktop Bus devices*.

The icon below the Apple desktop port represents a daisy chain of devices. That's because you can connect one Apple desktop device to the port and daisy-chain other desktop devices to that.

If you have an Apple Desktop Bus mouse, connect it directly to the Apple Desktop Bus, as shown in Figure 2-2. If you also have a detached Apple Desktop Bus keyboard, connect the keyboard to the computer and daisy-chain the mouse to the keyboard.

Important | If you have a mouse designed for the Apple IIe, you can use it with the Apple IIGS, but you can't connect it to the Apple Desktop Bus. Connect it to one of the slots on the main circuit board—slot 4 if possible.

If you connect a detached keyboard to your system, keep in mind that the built-in keyboard is still connected. With applications that tell you to press the Caps Lock key, you may need to lock the key down on both keyboards to get the application to work properly.

Monitor port

This port works just like the monitor port on an Apple IIe. Use it to connect a monochrome monitor or an NTSC composite color monitor.

If you find text in color hard to read in some programs, you can turn off the color by changing the Control Panel Display Type setting to Monochrome.

RGB color monitor port

This port lets you connect an analog RGB color monitor.

If you find text in color hard to read in some programs, you can turn off the color by changing the Control Panel Display Type setting to Monochrome.

Important
> If you had an RGB color monitor connected to an RGB card in the AUX. CONNECTOR slot on your Apple IIe, you won't be able to use that monitor with the Apple IIGS. The built-in RGB color capability on the Apple IIGS is for an analog RGB color monitor, while the RGB capability you got by adding an RGB card to the AUX. CONNECTOR slot on the Apple IIe was for a digital RGB color monitor.

Chapter 3

The Control Panel Program

The Apple IIGS is a versatile machine. You can control the speed of the microprocessor, the color of the text and background displayed on the screen, the responsiveness of the keys on the keyboard, the volume of the built-in speaker, and more. The way you control these things is through the Control Panel, a program that is built into the Apple IIGS.

While the Control Panel Program is permanently stored in the Apple IIGS, your system preferences are recorded in a special kind of battery-powered RAM that, unlike ordinary RAM, retains what's stored in it even after the power is turned off. This means you can make changes to your system configuration and save the configuration for next time. The battery should last between five and ten years. If it ever runs low, the Control Panel Program restores the original system configuration. If this happens, have your authorized Apple dealer replace the battery; then use the Control Panel Program to reconfigure your system the way you like it.

Incidentally, applications can override your settings for special effects and special reasons of their own. For example, you may have the speed set to normal, but the application can override your setting and run at the faster speed.

Getting to the Control Panel Program

To get to the Control Panel Program, hold down the Solid Apple key (⬥) while you turn on the Apple IIGS power switch. You'll see Figure 3-1.

❖ *Note:* On the Apple IIGS detached keyboard, the Solid Apple key (⬥) is labeled *Option*. If you're using the detached keyboard, press Option wherever this manual says to press ⬥.
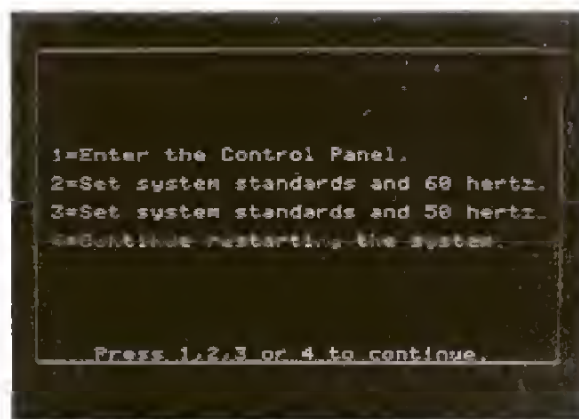
Figure 3-1
Gateway to the Control Panel Program

Press 1 to enter the Control Panel. The only time you should choose a menu item other than 1 is if you need to restore the standard Control Panel settings for the U.S. (press 2) or if you change your mind about entering the Control Panel (press 4).

Important	Do not press 3 unless you are operating your Apple IIGS in a country where the standard signal frequency for monitors is 50 hertz. If you choose the wrong hertz setting, the image on your monitor will roll or be out of alignment. To restore the standard U.S. settings, press ⬥-Control-Reset. Then press 2.

If the power is already on, you can get to the Control Panel Program by pressing ⌘-Control-Reset or ⌘-Control-Esc. Pressing ⌘-Control-Reset restarts the computer, so you should use ⌘-Control-Esc to get to the Control Panel if you are in the process of using an application and want to return to your application after using the Control Panel Program.

❖ *Note:* On the Apple IIGS detached keyboard, there is only one Apple key (⌘). It corresponds to the Open Apple key on earlier Apple IIe's.

Pressing ⌘-Control-Esc brings up the Desk Accessories menu, rather than the screen you get by pressing ⌘-Control-Reset. (See Figure 3-2.)
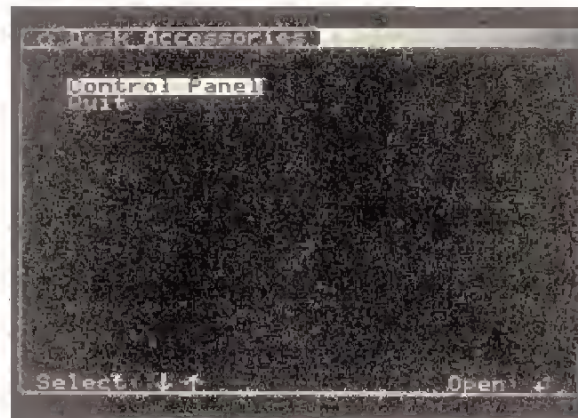
Figure 3-2
Desk Accessories menu

❖ *Alternate Display Mode:* The Desk Accessories menu will also include an accessory called *Alternate Display Mode.* The Apple IIGS displays information differently than earlier models of the Apple II. This interferes with the display of a few applications. Choosing the Alternate Display Mode desk accessory temporarily makes the display work the old way so those applications can run. When you're finished with the application, choose the accessory again to turn off Alternate Display Mode. The Alternate Display Mode is turned off automatically when you restart the computer.

❖ *By the way:* Some programs don't send you to the Desk Accessories menu when you press Ó-Control-Esc. If that's the case with an application you're using, you won't be able to use desk accessories while using that application. However, you can get to the Control Panel before or after using that application by starting up with the key pressed down or, if the power is on, by pressing -Control-Reset. If it's a ProDOS™ application, have your authorized Apple dealer upgrade the application with ProDOS 1.2. Once the application has been upgraded to ProDOS 1.2, you will be able to access desk accessories while using your application.

The Control Panel is different from other desk accessories in that it is stored in the permanent memory of the computer—not in RAM with the other desk accessories—but you can access it the same way you access other desk accessories, by pressing Ó-Control-Esc. If you don't have an *Apple IIGS System Disk* or if you haven't loaded any desk accessories by using the Finder, the Control Panel and Alternate Display Mode will be the only options on the Desk Accessories menu besides Quit.

Choose the Control Panel option and you'll see the display shown in Figure 3-3.
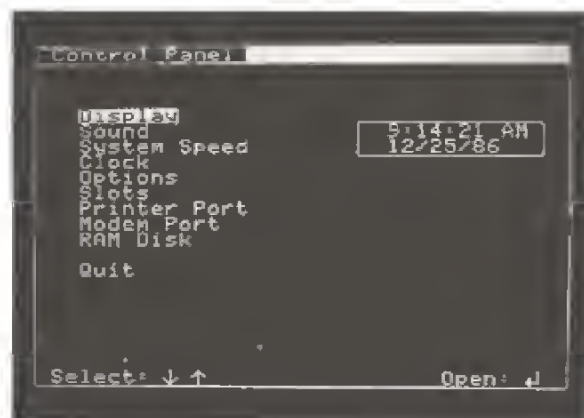
Figure 3-3
Control Panel Program Main Menu

Using the Control Panel Program

The Control Panel Program Main Menu lists all the functions you can customize. To select one of the functions:

1. Press Up Arrow or Down Arrow to highlight the option you want.

2. Press Return.

Depending on which option you select from the Main Menu, you'll see a secondary display like the one shown in Figure 3-4.
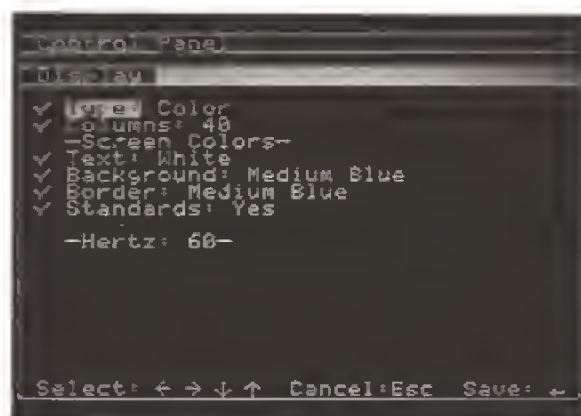
Figure 3-4
Control Panel Program display

To change one of the settings:

1. Press Up Arrow or Down Arrow to highlight the setting you want to change.

2. Press Right Arrow or Left Arrow until you see the setting you want. (The original settings are marked with a check in case you want to put things back the way you found them.)

3. Press Return to save the setting (or Esc if you decide you don't want to change the setting after all). You'll return to the Main Menu.

4. Choose Quit. If you got to the Control Panel by pressing Ő-Control-Esc from an application, you'll return to that application. If you got to the Control Panel by pressing -Control-Reset, the computer will start up the application in your startup drive.

Figure 3-5 gives you an overview of the system characteristics you can change and what you can change them to.

The sections that follow describe Control Panel options—system characteristics you can change and reasons you might want to change them.

Figure 3-5
Control Panel Program overview
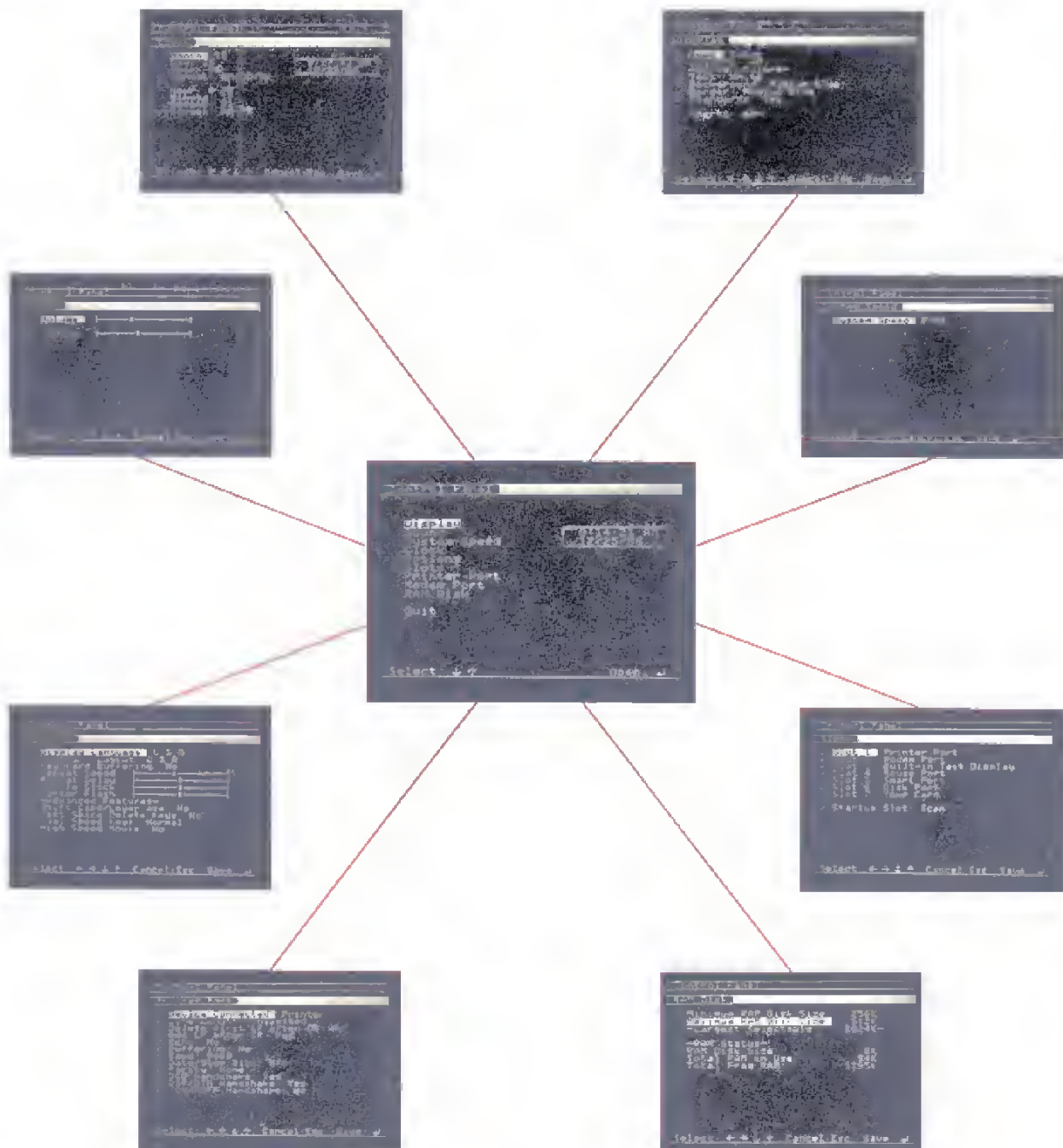
Display

Use the Display option to set the type of display (color or monochrome), the number of columns of text displayed, and the color or shade you'd like for text, background, and border.

Type

If you're using a color monitor, select Color as the type of display. If you're using a monochrome monitor or a television set, select Monochrome.

Incidentally, if the text displayed on your color monitor is fuzzy or has a color fringe when you use certain applications, try changing Type to Monochrome and see if you get a better picture. If there isn't enough contrast with a monochrome monitor, try setting Type to Color.

Columns

The Apple IIGS can display either 40 columns by 24 lines of text or 80 columns by 24 lines. If you choose 40 columns, the characters are twice as wide as the characters you get when you choose 80 columns. The advantage of the 40-column display is that the characters are bigger and easier to read. The advantage of the 80-column display is that you can work with larger documents, and the documents have a line length that more closely resembles typewritten documents.

Television sets and some color monitors don't have good enough resolution to display 80 columns of text clearly, so if you're using a television set or if you're having trouble reading text produced by your color monitor, set the Columns option to 40.

If you're using a monitor, and particularly if you use your Apple IIGS with business applications (like word processing and spreadsheet applications), set the Columns option to 80. Some applications *require* an 80-column display.

Some applications will override this setting and select the number of columns for you. Some older applications won't work unless the Control Panel is set to 40 columns.

Screen colors

If you have a color display, you can choose the color of your text, background, and border from 16 colors. If you have a mono-chrome monitor, you can choose the shade of your text, back-ground, and border from black, white, or 14 shades of gray. These settings affect only text-based applications.

NTSC color monitors switch to black-and-white mode to display text, so the text and background colors you select with the Control Panel will show up as shades of gray instead of in color. Only the border will be displayed in color.

As you change one color or shade to another by using Left Arrow and Right Arrow, the Control Panel displays the name of the color you've chosen and shows you what your selection looks like.

Important   If you are using an NTSC color monitor, the colors you select won't show up in color while you're using the Control Panel Program or other text-based applications. You will see the text and background in color only when you're using graphics-based applications that display text in the text portion (the bottom four lines) of the graphics screen.
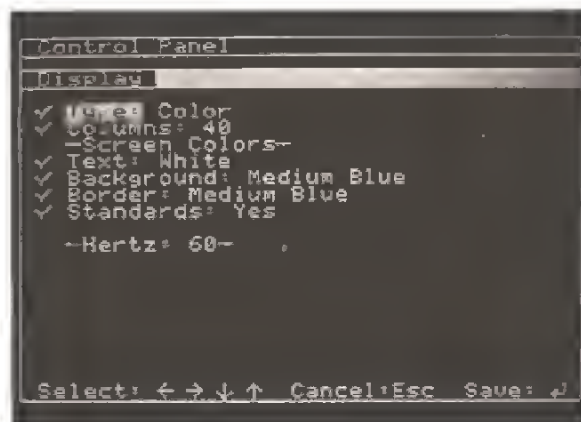
Figure 3-6
Choosing color of text, background, and border

After experimenting with different colors or shades, you may decide you liked the original colors best. To restore the preset colors, use Left Arrow or Right Arrow to change the Standard Colors option to Yes. If you decide you don't like the standard colors after all, you can change them by using the Text, Background, and Border options. You can't change the Standard Colors setting to No as a way of restoring your previous settings.

Important If the color contrast between text and background is such that you can't read the text to change the settings to something more readable, first try adjusting the contrast knob on your monitor. If that doesn't help, you can restore the original Control Panel settings by pressing ⌘-Control-Reset and then pressing 2.

If you don't want a border, set the background and border to the same color or shade of gray.

Hertz

The hertz setting indicates the frequency of signals sent to the monitor. Different countries have different standards; the U.S. standard is 60. This is not a matter of preference. If you need to change the hertz setting—if the image on your screen is rolling or out of alignment—press ⌘-Control-Reset. Then press 2. This restores the standard Control Panel settings for the U.S., including the correct hertz setting.

Sound

With the appropriate applications and peripheral devices, the Apple IIGS can play music and even simulate speech. Even the stuffiest software uses a bell or beep to accompany an error message. The Sound option lets you change the volume of sounds and the pitch of beeps generated by applications.

This option works a little differently than the others. Instead of using Left Arrow and Right Arrow to move through a list of choices, you press Left Arrow to reduce the volume and Right Arrow to increase the volume. The asterisk on the indicator bar will move to the right or left, and you'll hear a beep to reflect your action. (See Figure 3-7.)

Indicator bar

Asterisk
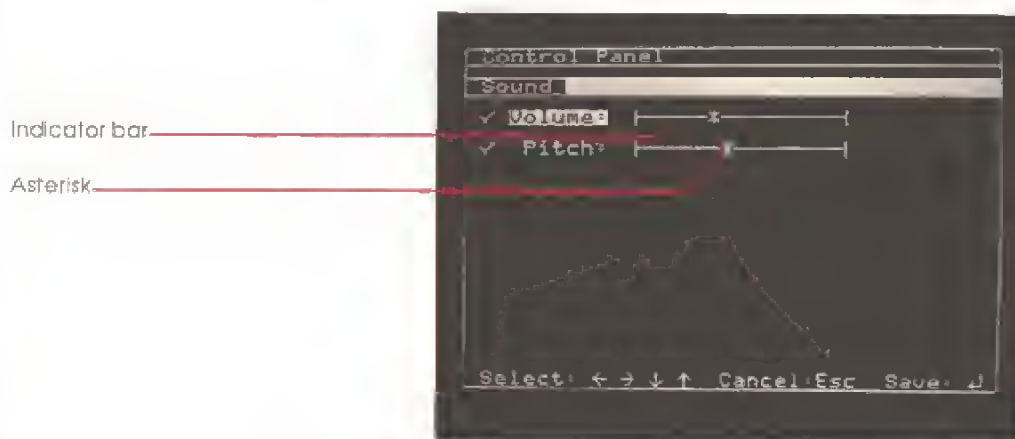
Figure 3-7
Changing volume

System speed

The Apple IIGS can operate at two speeds: fast and normal. *Fast* refers to the speed of the Apple IIGS when it's operating at a maximum speed of 2.8 megahertz (MHz), the top speed possible on the Apple IIGS. *Normal* refers to the speed of the Apple IIGS when it's operating at a maximum speed of 1 MHz, the top speed possible on earlier models of the Apple II.

Fast, the standard setting, is best for applications developed specifically for the Apple IIGS and for any Apple II application that involves a lot of calculations and sorting. The only time you have to change the speed to normal is when the fast speed throws off the application's timing or keeps it from running properly.

If you change from Normal to Fast after starting up an application, you may have to restart the application by pressing Ć-Control-Reset before the Fast speed will take effect.

Clock

The Clock option lets you set the time and date of the Apple IIGS's built-in clock and calendar. Once you've set the battery-operated clock, you won't have to set it again. The battery lasts between five and ten years. You can also use this option to change the date format from month first to day first or year first and to change the way time is displayed from the AM/PM format to the 24-hour format.

Options

Display Language and Keyboard Layout

The Display Language and Keyboard Layout options let you customize the **character set** and keyboard layouts for a variety of international keyboards or for the Dvorak keyboard. The **Dvorak keyboard** layout is an arrangement of keys designed to increase typing speed and efficiency by locating the keys used most often in the home row. The **Dvorak keyboard** is also called the *American Simplified Keyboard*.

Character set defines which of several possible alternates is displayed when you press a given key location on the keyboard.

Keyboard Buffering

The **keyboard buffer** is a special part of RAM where keystrokes are stored when the computer is busy and can't deal with them immediately. The buffer can keep track of up to 256 keystrokes. (After that, keystrokes are ignored.) This lets you type a series of instructions to the computer while the computer is doing something else—like saving a document on a disk. If you find this feature getting you into trouble (if you find yourself typing instructions that you later repent), you can turn off the keyboard buffer by using the Keyboard Buffering option.

Repeat Speed

When you hold down a key instead of pressing and releasing it, the key repeats, like thisssssssss. You can change the speed at which keys repeat by using the Repeat Speed option. Press Right Arrow to make keys repeat faster; Left Arrow to make keys repeat slower.

Repeat Delay

You can use the Repeat Delay option to change the amount of time it takes from the time you press and hold down a key until it starts repeating.

Double Click

Double clicking means pressing and releasing the mouse button twice in rapid succession. It's a shortcut you'll learn about when you use mouse-based applications. The application interprets your two clicks as a double-click only if the two clicks are done within a certain time interval. You can change the time interval by using the Double Click option.

Cursor Flash

In many applications, the cursor flashes to distinguish it from other characters on the screen. You can speed up or slow down the interval between flashes by using the Cursor Flash option.

Advanced features

The next few features are somewhat esoteric, but if you think they might be useful, give them a try.

Shift Caps/Lowercase

Ordinarily, when you push Caps Lock down, everything you type is capitalized; to get lowercase characters, you have to release Caps Lock. But by setting the Shift Caps/Lowercase option to Yes, you can have Caps Lock down and get lowercase characters by holding down Shift while you type. In other words, by activating this feature, Shift has the opposite effect that it does when Caps Lock is not pressed down.

Fast Space/Delete keys

When you hold down the Space bar, the space repeats like any other character, and you get a row of spaces. Likewise, when you hold down Delete, successive characters are deleted until you release the key. By setting Fast Space/Delete to Yes, you can double the speed of these two actions by holding down Control while holding down Space or Delete.

Dual Speed Keys

Setting the Dual Speed Keys option to Yes doubles the speed of the cursor's movement when you hold down an arrow key while pressing Control.

High Speed Mouse

When you move the mouse across your desk, a pointer moves a corresponding distance across your screen. Setting the High Speed Mouse option to Yes makes the pointer move twice as far for the same mouse movement. It's useful if you're short on desk space.

Activating slots or ports

Software designed for earlier models of the Apple II expects to find devices connected to slots inside the computer. For this reason, each port on the Apple IIGS is designed to impersonate a slot containing a card. (See Table 2-1.)

Because each port impersonates a slot, you can't have both the port and the corresponding slot active at the same time. You activate one or the other by using the Slots command. In Figure 3-8, the printer port is active, but the modem port is not. The user has chosen to activate the card in slot 2 instead of the modem port. Notice that when a slot is activated, the words Your Card replace the words describing the port.

Important	Your changes won't take effect until you restart your computer.

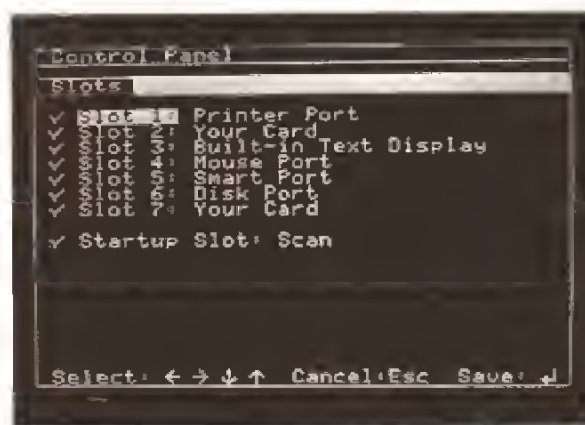**Figure 3-8**
Activating slots or ports

❖ *About the disk drive port:* When 3.5-inch drives are connected to the disk drive port, they appear to be connected to a card in slot 5. When 5.25-inch drives are connected to the disk drive port, they appear to be connected to a card in slot 6. When the disk drive port impersonates a card in slot 5, it's described as a "smart port." (See Figure 3-8.)

When you have an AppleTalk network cable connected to the printer or modem port, the port impersonates a card in slot 7—not slot 1 or 2 as you would expect. But because the AppleTalk cable plugs into one of the two serial ports, the Control Panel Program won't let you activate the printer port, the modem port, and AppleTalk all at the same time.

Changing the startup drive

When you turn on the Apple IIGS power switch, the first thing the computer does is check its slots for a disk drive controller card—an interface card that controls one or two disk drives. It looks first at slot 7, the highest-numbered slot. If it doesn't find a disk drive controller card there, it looks in slot 6, the next-highest-numbered slot, then slot 5, and so on, until it finds a disk drive controller card. When it finds a disk drive controller card, it checks the disk drive connected to that card for a startup disk. This method of looking for a startup device is called **scanning.**

Generally this system works fine, but what if you want to bypass the disk drive connected to slot 6 and start up from the disk drive connected to slot 5? What you do is change the startup slot from Scan, the standard setting, to slot 5 or any other slot containing the drive you want to start up from.

But what if your disk drives are connected to ports? From the computer's point of view, ports look just like slots with cards in them. A 5.25-inch drive connected to the disk drive port emulates a disk drive connected to a card in slot 6. A 3.5-inch drive connected to the disk drive port emulates a disk drive connected to a card in slot 5. (See Table 2-1.) Just choose the slot that corresponds to the drive you want to start up from.

You'll also be offered the option of starting up from a RAM disk or a ROM disk. Starting up from a **RAM disk** means starting up from an application that you've copied into the memory on your Apple IIGS memory expansion card.

You should not select the RAM disk as your startup device unless you have a memory expansion card in the memory expansion slot and you've copied an application to the RAM disk. See the *Apple IIGS Memory Expansion Card* for more information.

Starting up from a **ROM disk** means starting up from an application permanently stored on a memory expansion card. (Depending on what kind of memory expansion card you get, you may or may not have applications permanently stored on a ROM disk.) The manual that came with your memory expansion card will tell you more about starting up from a RAM disk and a ROM disk.

Changing printer/modem port settings

The printer and modem ports work a little differently than the other ports on the back panel. Whereas most of the ports are configured to interact with a particular type of device (a disk drive, a monitor, a joystick) in a particular way, the printer and modem ports are designed so you can change their configuration. They are general-purpose serial ports.

A **remote computer** is the computer on the other end of the phone line. It can be very remote (across the country) or only slightly remote (across the office)

Different printers and different remote computers expect to receive information at different speeds and in different configurations. That's why it's important that you be able to change the way information is sent.

The printer port is configured to work automatically with the ImageWriter series of printers and with many other popular serial printers. The modem port is configured to work automatically with most commercial information services you'll be accessing with your modem. However, if your device requires a different configuration or if you want to use a modem in the printer port and a printer in the modem port, you'll need to change the data configuration. There are two ways to do this: from within an application or by using the Control Panel Program. The configuration you specify in an application overrides the Control Panel setting for a port.

How do you know whether your application is overriding the Control Panel settings for the port? If the application gives you a list of printers and asks you to choose yours from the list, it's going to send the document in the correct configuration for the printer you choose and will ignore the Control Panel settings for the port.

❖ *A tip:* Even if your printer is not on the list, try selecting each of the printers on the list. If your printer happens to have the same configuration as one of those on the list, you'll save yourself the bother of supplying specifications about your printer.

If the application asks you to supply a list of specifications about how your printer or the remote computer wants to receive data (baud, number of data bits, stop bits, and the like), it's going to send the document according to those specifications and will ignore the Control Panel settings for the port. You should be able to find the specifications for your printer in the manual that came with it or, for an information service, in the brochure you got when you subscribed to the service.

❖ *By the way:* The specifications you'll be asked for in an application are the same specifications you'll set by using the Control Panel Program, so if you aren't sure what the application means by data bits, stops bits, and parity, read the explanations in the following sections.

If the application does *not* give you a list of printers and does *not* ask for your printer's specifications, the document will be sent according to the specifications in the Control Panel for the port your printer is connected to.

Here are the standard settings for the printer port and the modem port.

Table 3-1
Standard port settings

Function	Printer port	Modem port
Device Connected	Printer	Modem
Line Length	Unlimited	Unlimited
Delete First LF After CR	No	No
Add LF After CR	Yes	No
Echo	No	No
Buffering	No	No
Baud	9600	1200
Data/Stop Bits	8/1	8/1
Parity	None	None
DCD handshake	Yes	Yes
DSR/DTR handshake	Yes	Yes
XON/XOFF	No	No

Important   Try using your printer or modem before changing any of the settings. If it works, you'll save yourself some time. If it doesn't, you'll have some information (unintentional double-spacing, absence of carriage returns, lost characters, and so on) that will help you figure out which settings need to be adjusted.

If you need to reconfigure one of the ports, check the manual that came with your printer or the service you're trying to exchange information with to see what its specifications are. Then use that information to fill in the baud, the number of data bits, and so on. The following sections explain what the various specifications mean and how to decide what settings to choose.

Device Connected

The Device Connected setting is fairly straightforward. Select Printer if you're connecting a printer or plotter to the port. Select Modem if you're connecting a modem to the port.

Line Length

Line length indicates the number of characters that your printer will print per line before generating a **carriage return** (sending the "carriage" to the left margin to start a new line). Many applications let you set the line length from within the application. If that's the case or if you find the computer adding carriage returns where they don't belong, choose Unlimited and the computer won't try to control line length.

If, on the other hand, you find your printer ignoring the right margin and printing right off the page, you can use this option to insert a carriage return after every 40, 72, 80, or 132 characters.

If you're connecting a modem, leave the line length set to Unlimited.

Delete First LF After CR

Some printers and applications automatically generate a **line feed** (LF)—go to the next line—after each carriage return (CR). Others don't. If you try printing something and everything comes out unintentionally double-spaced, make sure the automatic line feed switch on your printer is set to OFF. If you still get double spacing, the extra line feed is coming from your application. If you can't turn it off there, you can use the Delete First LF After CR option to cancel the extra line feed.

Add LF After CR

Suppose you try printing something and you don't get any line feeds—the lines are printing on top of each other and all you get is one line of typed smudge. Set the automatic line feed switch on your printer to ON or use the Add LF After CR option to add an extra line feed after each carriage return.

Echo

When you send a message through your modem, you can elect to have the message displayed on your own screen as well as on the screen it's being sent to. This is called **echo**, and it's a nice way to assure yourself that your message is being sent correctly. In most cases, you won't need to select the Echo option because the computer you're sending the message to will probably send an echo of the message to your screen as a way of confirming that it received your message. If you select the Echo option and the other modem sends an echo, you'll be seeing double.

A **full-duplex modem** will echo characters back to your monitor. A **half-duplex modem** won't. If you're communicating with a full-duplex modem, set Echo to No. If you're communicating with a half-duplex modem, set Echo to Yes. If you don't know what kind of modem is on the other end of the phone line, select Yes. If you find everything coming through double, change to No. Most information services, like CompuServe and The Source, use full-duplex modems.

Buffering

The buffer is a special holding area in RAM that holds information until the computer or peripheral device is ready to deal with it. Don't change this setting unless the manual that came with your device tells you to.

Baud

The Apple IIGS can send and receive information at a wide range of speeds from 50 bits per second to 19,200 bits per second. The important thing is that the computer and the printer or modem agree in advance on the speed that the bits will be traveling.

Bits per second (bps) is more commonly referred to as **baud,** which means "rate of transmission." The computer is more adaptable about baud than the device, so check what baud the device uses and select the same speed for the computer by using the Baud option. You'll usually find baud listed on a specifications page in the manual that came with your printer or modem. The most common baud for modems is 1200. The most common baud for printers is 9600.

A baud of 300 is about one double-spaced typed page per minute

Data bits/stop bits

The computer sends and receives each character of data out the serial port as a string of bits. Characters can be represented with seven or eight data bits. It doesn't matter which you choose as long as there is agreement between the computer and the device it's communicating with. The most common data format is eight data bits. The manual that came with the device will indicate what setting to use.

Stop bits are used to mark the end of each string of data bits. Some devices expect to receive one stop bit; others expect to receive two.

Parity

Some devices expect to receive a parity bit, which is used by the receiving device to make sure the data didn't get garbled during transmission. There are three parity options you can select: odd parity, even parity, or no parity. Most devices don't use parity checking, so if you're unsure about what to select, choose No Parity.

If the devices agree on **odd parity** as an error-checking system, the sending device adds an extra bit set to either 0 or 1 to make the total number of bits add up to an odd number. For example, the 7-bit ASCII code for the letter *A* is 1000001, which adds up to 2, an even number. The sending device would add an extra 1 to make it odd. The receiving device adds up the bits. If the total is odd, chances are the message is OK; if it's even, there was an error in the transmission.

If the devices agree on **even parity,** the sending device adds an extra bit set to either 0 or 1 to make the total number of bits an even number.

Handshake signals

DCD, DSR/DTR, and XON/XOFF are different protocols that a peripheral device can use to tell the computer things like "I'm ready when you're ready" or "Give me a second to catch my breath." Signals that regulate the flow of data between the computer and a peripheral device are called **handshake signals.**

Don't change these settings unless the manual that came with your device specifically tells you to set them in a particular way.

DCD stands for Data Carrier Detect; **DSR** for Data Set Ready; and **DTR** for Data Terminal Ready. **XON** and **XOFF** are ASCII characters. XOFF tells the **transmitting device** to halt transmission of characters. XON tells the transmitting device to resume transmission of characters.

RAM disk

If you have a memory expansion card connected to your Apple IIGS, you can designate a portion of the memory on the card to be used as a RAM disk. A **RAM disk** is memory that is treated like a disk. You format it, access it by volume name, and copy or save applications and documents on it. The advantage of using a RAM disk is that the computer can get information from it much faster than from a disk. The disadvantage is that anything stored on the RAM disk is lost when you turn off the power.

You don't have to designate any of the space on your memory expansion card for use as a RAM disk (and there's no reason to with newer applications because they will take advantage of the extra memory automatically). But experienced users, using older applications, may want to speed up access to applications and information by using the RAM disk. This option lets you specify the minimum and maximum amount of free RAM you want to set aside for use as a RAM disk. You change the minimum and maximum amount of RAM you want to reserve for use as a RAM disk in increments of 32K. The minimum amount can't exceed the maximum amount. If you try to raise the minimum above the maximum, the maximum will be automatically adjusted.

RAM disk settings don't take effect until you restart the computer by pressing ⌂-Control-Reset.

❖ *Note:* Decreasing the maximum RAM disk size won't erase what's already stored on the RAM disk.
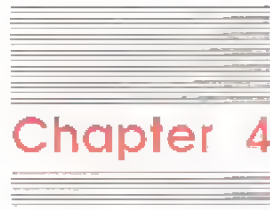
Chapter 4

The Mouse Interface

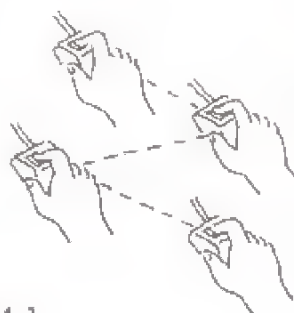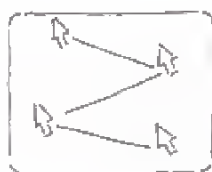You can change the responsiveness of the mouse by using the Control Panel Program, which is explained in Chapter 3.

Figure 4-1
Pointing

This chapter defines mouse terms and describes the standard user interface for mouse-based applications. Applications that use the mouse will include detailed instructions for using the mouse in that application, but the instructions may assume some familiarity with terms like *clicking, cutting, pasting, dragging, selecting,* and *choosing* from *pull-down menus.* If you have questions that aren't answered in the manual provided with the application, come back to this chapter for clarification.

When you move the mouse across your desk, a small arrow, called a *pointer,* moves in a corresponding way across the screen. (See Figure 4-1.)

Clicking

Moving the pointer to something on the screen, and then pressing and releasing the mouse button is called **clicking.** (See Figure 4-2.) You click something when you want to select that item for some action.

Double clicking means pressing and releasing the mouse button twice in rapid succession. It's a shortcut used in many mouse-based applications. Where the shortcut leads depends on the application. Again, the manual provided with the application will tell you how double clicking is used in that application.

Figure 4-2
Clicking

Selecting

When you point to a word or picture and use the mouse button, you are selecting that word or picture for some action.

Selecting is an important concept in mouse-based applications. You select something; then you tell the application what action to perform on the selected text or picture. For example, you might select a block of text and then tell the application to delete it or move it somewhere else in the document.

To select a block of text, point just to the left of the first character, hold down the mouse button, move the pointer to the right of the last character, then release the mouse button. The text between the first and last character will be **highlighted** to show that you selected it. (See Figure 4-3.)

Holding the mouse button down while you move the pointer is called **dragging.**
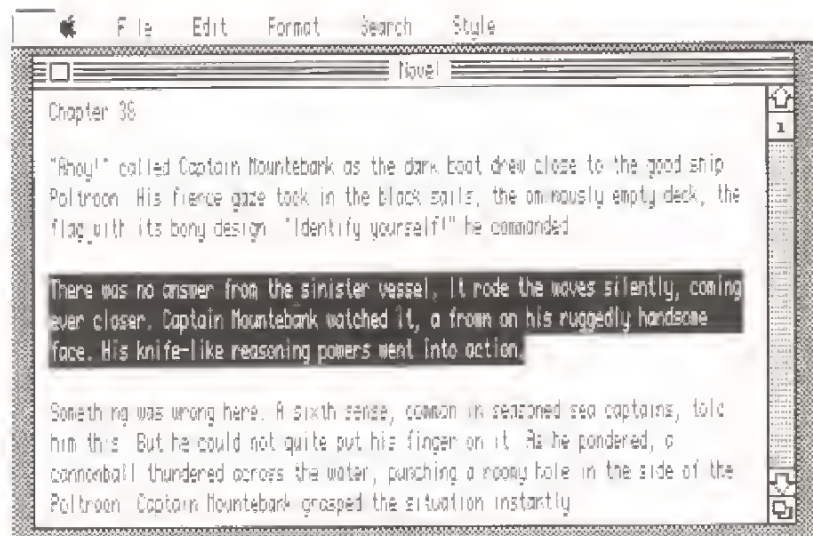

Figure 4-3
Dragging to select

Dragging

Besides dragging across text to select it, you can use the mouse to drag objects from one place on the screen to another. You'll do a lot of dragging if you decide to use the DeskTop on the Apple IIGS optional System Disk as your utility application. For example, you'll drag a picture of a document to a picture of a trash can to erase the document from the disk. Pictures that represent things like documents and trash cans are called **icons.**

Pull-down menus

Menus in mouse-based applications stay out of sight until you need them. In this respect, they are like those maps you may have had in elementary school. The teacher pulled down the map to teach geography, then rolled it up to demonstrate subtraction on the blackboard.

To pull down a menu in a mouse-based application, just point to the title of the menu and hold down the mouse button. (The menu will remain visible until you release the mouse button.)

Each word or picture on the **menu bar** represents a different menu. Each application has its own menus, but there is almost always one called the **File menu**. The File menu is the menu you'll use when you want to do something to the document as a whole—save it on a disk, quit using it, and so on.
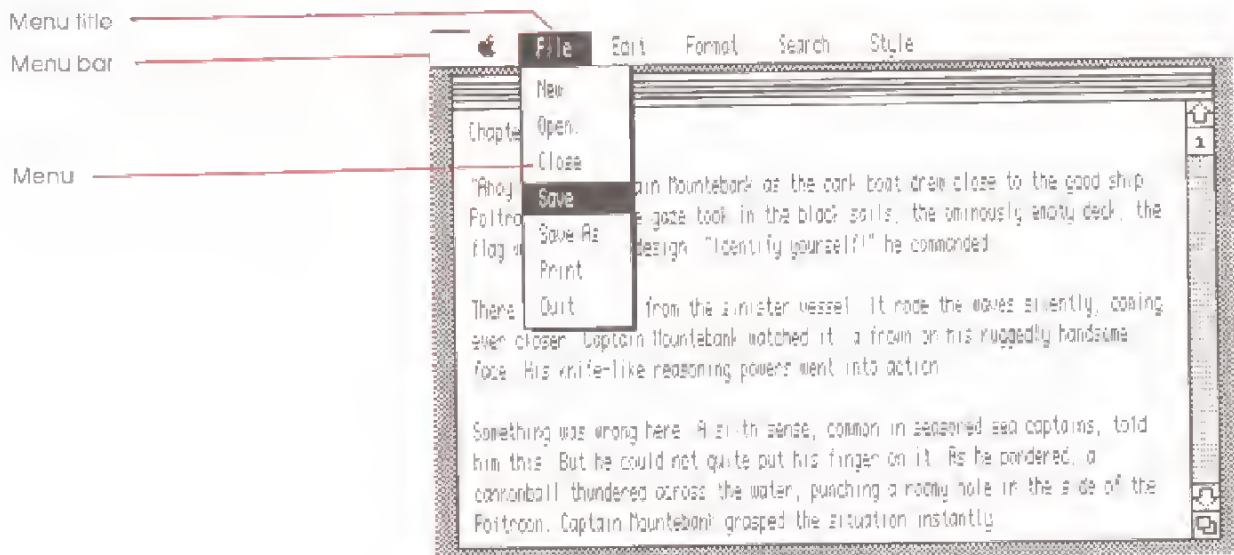
Menu title

Menu bar

Menu

Figure 4-4
Menu

Choosing

To choose a **command** from a menu, point to the **menu title**, hold down the mouse button, move the pointer down the list until the command you want is highlighted, then release the button. (See Figure 4-5.)
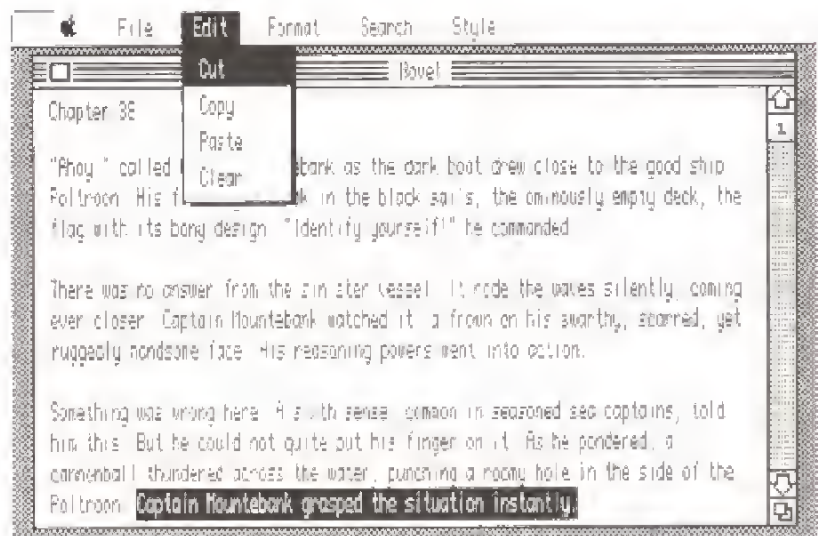

Figure 4-5
Choosing a command

Many mouse-based applications let you use a certain key combination (like pressing Ó-S) instead of choosing a command from a pull-down menu. Typing key combinations is faster for some experienced users and touch typists, but it's not as intuitive. (You have to remember the key combinations instead of finding the command you want on a menu.) Keyboard equivalents to pull-down menu commands are usually shown on the menu.

Editing

Applications that use text have a blinking symbol, that marks the **insertion point** — the place where what you type will be inserted. (See Figure 4-6.) When you start a document, the insertion point is usually in the upper-left corner of the screen. As you type, the blinking symbol moves to the right. When you reach the right margin, the insertion point moves to the start of the next line. If you are in the middle of a word, when you reach the right margin, the whole word moves to the next line automatically. This is called **word wraparound.**
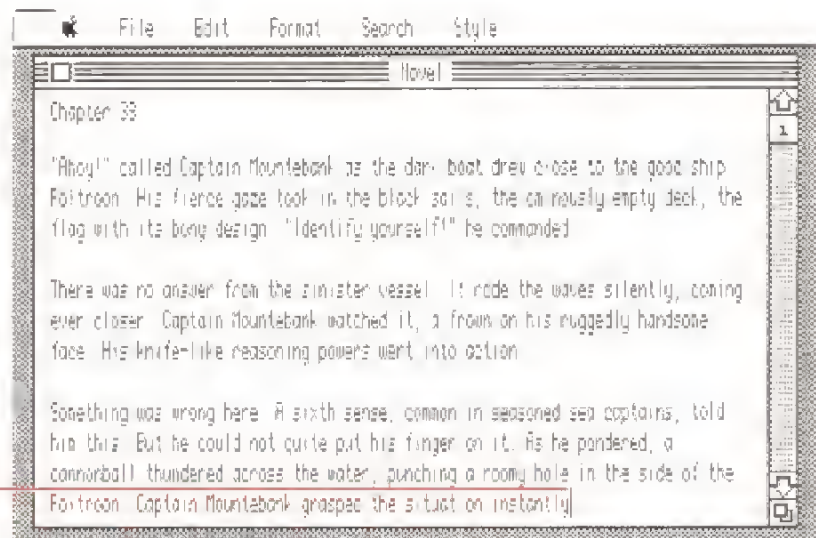
Insertion point

Figure 4-6
Insertion point

Inserting

To insert a word or sentence in the middle of a document, scroll the document until you come to the place where you want to insert text, move the pointer to the exact place where you want to insert text, click the mouse button, and start typing. (See Figure 4-7.) Words to the right of your insertion will move over automatically and wrap around to the next line to make room for what you type.

To insert text:

1. Move pointer to where you want to insert text.

2. Click mouse button.
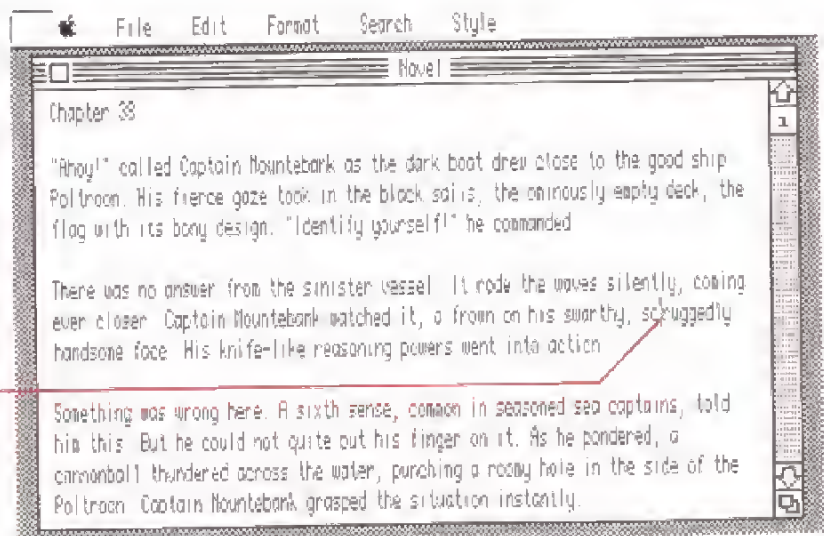
3. Type.

Insertion point

Figure 4-7
Inserting text

Deleting

To delete a character, a word, or a sentence from the middle of a document, scroll the document until you see the text you want to delete, position the pointer just to the right of the text you want to delete, click the mouse button, and press Delete until the unwanted text is deleted. (See Figure 4-8.)
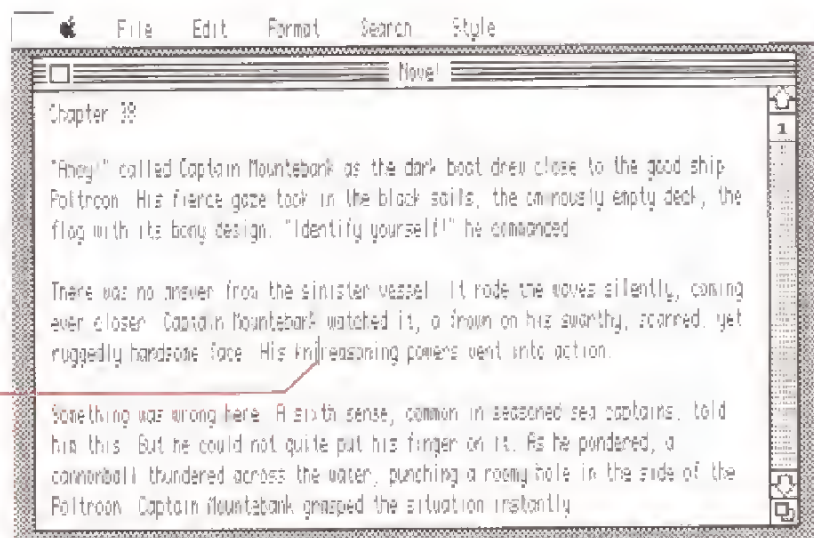
Insertion point

Figure 4-8
Deleting text

To delete longer passages, some applications let you drag across the text to select it and then press Delete once to delete the whole passage.

Cutting and pasting

To move text from one place to another, move the pointer to the beginning or end of the section you want to move, and drag across the text to select it. Then choose the Cut command from the **Edit** menu. (See Figure 4-9.) When you choose Cut, the selected text disappears from the screen.

To cut text:

1. Drag across text to select it.
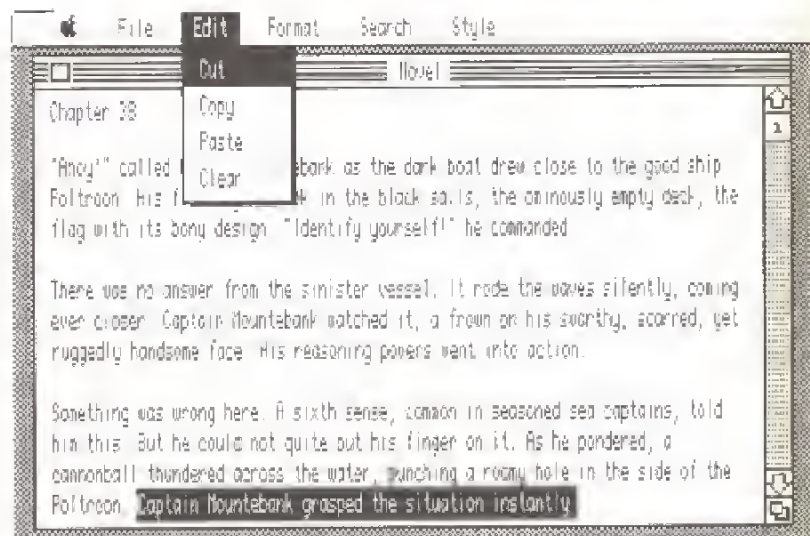
2. Choose Cut from Edit menu.

Figure 4-9
Cutting text

Though it seems to have been deleted, the text you cut is actually stored on the **Clipboard,** a special holding area in the memory of the computer. To insert the text you just cut, move the pointer to the place you want to insert it, click the mouse button, and choose Paste from the Edit menu. When you choose Paste, the text reappears at the new location. (See Figure 4-10.) The Clipboard holds only one clipping at a time. If you cut a second block of text without pasting the first block of text, the first block you cut is lost.

To paste text:

1. Move pointer to where you want to paste text.

2. Click mouse button.

3. Choose Paste from Edit menu.
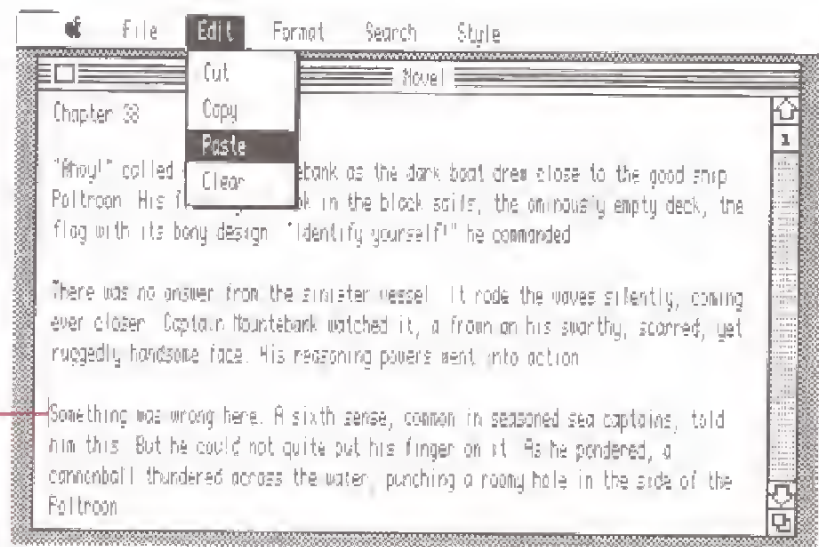
Insertion point

Figure 4-10
Pasting text

Copying

To copy a block of text, select it, then choose the Copy command from the Edit menu. This puts a copy of the selected text in the Clipboard. Next, move the pointer to the place you want to insert the text, click the mouse button, and choose Paste from the Edit menu.

Windows

With mouse-based applications, you look at your document through a **window**. (See Figure 4-11.) With some applications, you can have several windows on the screen. This lets you see more than one document at a time.

The contents of windows vary, but most windows have these things in common: a title bar, a close box, a size box, and a scroll bar. You can use these tools to change what you see through a window, change the size of a window, move a window, close a window, and activate a window.
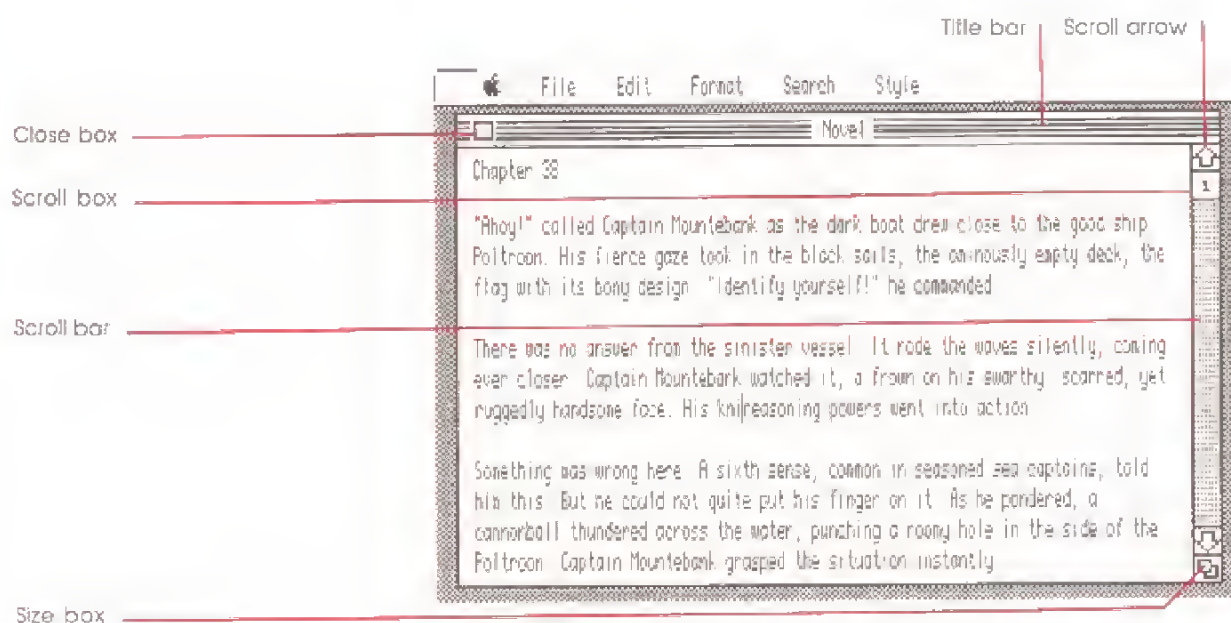

Figure 4-11
Parts of a window

Changing the size of a window

Most of the time, you want the window you're working in to fill the whole screen so you can see as much of the document as possible. But sometimes it's useful to shrink the window so you can see more than one document at a time.

To shrink a window, point to the **size box** and drag it up and to the left. To expand a window, point to the size box and drag it down and to the right.

Moving a window

To move a window, point anywhere in the **title bar** (except on the close box), and drag the window wherever you want to put it.

Activating a window

Some applications let you have several windows on the screen at one time, but only one of those windows can be active. A window has to be active before you can make any changes to the information in it. The active window's title bar is highlighted to distinguish it from nonactive windows on the screen.

To **activate** a nonactive window, use the size box to shrink the active window until you can see the window you want to activate in the background. Then click anywhere on the nonactive window and it will zoom into the foreground and become the active window.

Changing the view through a window

If a document is too long to fit in the window, there will be a bar running along the right side of the window. This is the **scroll bar.** When you drag the **scroll box** along the scroll bar, different parts of the document come into view. The scroll bar represents the total length of your document. So, if you want to see the middle of your document, drag the scroll box to the middle of the scroll bar. To scroll one line at a time, click the **scroll arrow** that points in the direction of what you want to see. To scroll a windowful at a time, click within the gray area of the scroll bar above or below the scroll box.

If a document is too wide to fit on the screen, there will also be a scroll bar along the bottom of the window. Drag the scroll box left to see the leftmost side of the document. Drag it right to see the rightmost side of the document.

Closing a window

To close a window, click on the **close box** in the upper-left corner of the window. This has the same effect as choosing the Close command from the File menu.

The Finder

If you decide the mouse interface is the interface for you, you'll probably want to get the *Apple IIGS System Disk,* which includes the Finder. The Finder is both a program selector and a utility application.

By starting up with the Finder, you can select the applications and documents you want to work on by pointing to icons. Switching to a different application or document is as simple as selecting a different icon.

Between applications, you can use the mouse-based Finder utilities. To delete a document, you just drag a picture of the document to a picture of a trash can. To move a document to a different disk, you just drag a picture of the document to the picture of the disk. To put a document in a subdirectory, you just drag the picture of the document to the picture of a file folder. To rename a document, subdirectory, or disk, you just highlight the icon of the document, folder, or disk and type the new name.

Troubleshooting

This troubleshooting guide concentrates on problems that could arise from using Apple IIe applications and peripheral devices on the Apple IIGS and on problems involving Control Panel settings.

Important   If the problem involves a loose connection, turn off the power and wait at least 30 seconds before connecting anything to or disconnecting anything from the computer.

❖ *Diagnostic test:* If you think there's a serious problem with your computer, you can run a diagnostic test by pressing ⌂ and ⌘ while you turn on the power or by pressing Control-⌂-⌘-Reset if the power is already on. After about 35 seconds you should see the message System Good. If you see the message System Bad followed by a string of letters, contact your authorized Apple dealer.

Trouble starting up

Problem	Analysis	Solution
You get the message Check Startup Device.	You forgot to put a disk in the startup drive, or it's a data disk and not an application disk.	Put a startup disk in the startup drive and turn on the power.

Problem	Analysis	Solution
The computer tries to start up by using the "wrong" disk drive.	Unless you've used the Control Panel Program to change the startup slot, the computer will attempt to start up by using the disk in the disk drive connected to the highest-numbered slot or corresponding port. A 5.25-inch disk drive in the disk drive port corresponds to slot 6. A 3.5-inch disk drive in the disk drive port corresponds to slot 5.	Put your startup disk in the disk drive that the computer is using as the startup drive or change the startup slot by using the Control Panel Program, explained in Chapter 3.
The computer doesn't recognize your UniDisk 3.5.	Your UniDisk 3.5 is connected to a disk drive controller card instead of to the disk drive port and you're using the Fast system speed.	Connect your UniDisk 3.5 to the disk drive port or change System Speed in the Control Panel to Normal.
You get the message UNABLE TO LOAD PRODOS.	Fast speed might be interfering with the application.	Try setting System Speed in the Control Panel Program to Normal.
Typing PR# and a slot number activates one of your disk drives instead the device you intended.	The Control Panel is set to Your Card for that slot and there's no card in the slot. When it can't find a card, it doesn't know what to do.	If your disk drive keeps spinning, press Control-Reset to stop the disk drive. Change the Control Panel setting to the port instead of Your Card.

Trouble using an application

Problem	Analysis	Solution
You can't get to desk accessories by pressing Ó-Control-Esc.	Your application uses a version of ProDOS earlier than 1.2, which doesn't give you access to desk accessories.	Have your authorized Apple dealer upgrade the application to ProDOS 1.2.
The Desk Accessories menu appears unexpectedly.	You tried to access desk accessories earlier from an application that didn't let you. The computer held on to your request and complied as soon as possible.	Choose Quit from the Desk Accessories menu. Have your authorized Apple dealer upgrade the version of ProDOS on your application disk so you can access desk accessories when you want to.
The application works on an Apple IIe but not on an Apple IIGS.	Fast speed might be interfering with the application.	Try setting System Speed in the Control Panel Program to Normal.

Trouble using the keyboard

Problem	Analysis	Solution
The application tells you to press Option and there is no Option key on your keyboard.	On the Apple IIGS detached keyboard, the Solid Apple key (○) is labeled Option.	Press Solid Apple (○) wherever the application says to press Option.
The application tells you to press the Apple key and you don't know which to use.	On the Apple IIGS keyboard, there is only one Apple key (○).	Press Open Apple (○) wherever the application says to press Apple.

Trouble using the mouse

Problem	Analysis	Solution
You run out of space on your desk before the mouse pointer on the screen reaches your destination.	You started your mouse move too near the edge of your desk or too near the stack of books and papers in the middle of your desk.	Lift the mouse off the desk and move it back to the center of the desk. The pointer won't move until you put the mouse back on the table and move it.
The mouse movements are jerky.	The ball on the bottom of the mouse is probably grimy.	Clean the mouse ball according to the directions that follow.

Cleaning the mouse

Figure A-1
Mouse belly

1. Turn the mouse over. On its belly you will see a black, plastic disc with a hole in its center. The disc has a round mark near its edge, which should be pointing to the letter *L* (for *locked*) engraved in the mouse. (See Figure A-1.)

2. Turn the disc counterclockwise one-eighth of a turn. This will bring the mark on the disc opposite the letter *O* (for *open*).

3. Cup your hands around the mouse and turn it right side up. The disc will fall out with the ball.

4. Wipe the ball clean. If it's greasy, wash it with warm, soapy water and dry it thoroughly with a lint-free cloth.

5. Turn the mouse back upside down. If there is any material in the hole on its bottom, gently pick it or shake it out. Do not try to blow it out. This may just drive the material farther inside. Do not attempt to wash out the cavity or use solvents in it.

6. Place the clean ball back in its hole.

7. Replace the plastic disc, orienting it so that the mark on its rim is near the letter *O*. Turn it one-eighth of a turn clockwise, bringing the mark to the letter *L*. This should lock the disc in place.

Trouble with the display

Problem	Analysis	Solution
The image on the screen is rolling or out of alignment.	The Apple IIGS is sending signals to the monitor according to the foreign standard (50 hertz) instead of the U.S. standard (60 hertz).	Press ⌘-Control-Reset and then press 2. This restores the standard Control Panel settings for the U.S., including the standard frequency of 60 hertz.
Text and background colors are so similar that the text is unreadable.	There isn't enough contrast between text and background.	Try adjusting the contrast and brightness on your monitor. If that doesn't improve the contrast, you can restore the original Control Panel settings for text and background by pressing ⌘-Control-Reset and then pressing 2. If there still isn't enough contrast, try setting the display type in the Control Panel Program to Color even if you're using a monochrome monitor.
Little apples and check marks appear in a line of uppercase, inverse text.	The apples and check marks are called **MouseText**. MouseText characters replaced a redundant set of characters in earlier models of the Apple II. Older applications using that redundant character set will now display MouseText characters in place of uppercase, inverse text.	The MouseText characters don't affect the way an application works, so if they don't bother you, go ahead and use the application. If they do bother you, ask your authorized Apple dealer or the developer of the application if there is an upgraded version of the application.

Problem	Analysis	Solution
There isn't enough contrast between colors on the display.	The application was designed for earlier models of the Apple II. The Apple IIGS generates slightly different colors.	Try a different setting for display type in the Conrol Panel Program. The display type doesn't have to match the kind of monitor you have.
The screen is full of 2's or meaningless characters.	The application was designed for earlier models of the Apple II.	Leave the application disk in the drive, press Ć-Control-Esc, choose Alternate Display Mode from the Desk Accessories menu, and press Return. When you're finished using the application, choose the accessory again to restore the standard display.
You can't get a color display even though you're using a color monitor.	Either the monitor is set to monochrome/black-and-white mode or you're using an NTSC color monitor with a text-based application and that's the display you're supposed to get. Unlike analog RGB color monitors, NTSC color monitors can't display text clearly in color mode so they switch automatically to monochrome mode for text-based applications.	Change the switch on your monitor to color mode if there is one. If you're using an NTSC monitor with a text-based application, you don't need to make any adjustments. You'll get a color display when you use graphics-based applications.

Problem	Analysis	Solution
The 40-column display changes to an 80-column display and clears the screen when you press Control-Reset.	You had the Control Panel set to 80 columns, but the application was using a 40-column display. Pressing Reset put you back in 80 columns and cleared the screen.	It's not really a problem unless you pressed Reset by mistake. Reset is in an unusual location to keep you from pressing it accidentally.

Trouble saving a document

Problem	Analysis	Solution
Your application asks for the slot and drive of the disk you want to save to, but your drive is connected to the disk drive *port*.	Earlier models of the Apple II didn't have ports, so slot and drive number was a logical way to identify the location of your disk.	3.5-inch disk drives connected to the disk drive port correspond to slot 5. 5.25-inch disk drives connected to the disk drive port correspond to slot 6.

Trouble printing

Problem	Analysis	Solution
Unintentional double or triple spacing.	An extra line feed is being inserted by the application, the Control Panel Program, or the printer.	Change the application's line feed setting to OFF, or use the Control Panel Program, explained in Chapter 3, to change the line feed setting for the printer port, or turn off the automatic line feed switch on the printer.

Problem	Analysis	Solution
Lines are printing on top of each other.	No line feed instruction is being sent to the printer after the carriage return instruction.	Use the Control Panel Program, explained in Chapter 3, to add a line feed after the carriage return for the printer port or turn on the automatic line feed switch on the printer.
You get a line of meaningless characters that bears no resemblance to your document.	You're using either the wrong baud, the wrong number of data bits or stop bits, the wrong kind of parity, a loose cable, or the wrong cable.	First check the tightness of the cable because that's the easiest thing to adjust. If that's not the problem, check the manual that came with your printer to see how your printer expects to receive data from the computer, and then use that information to answer printer-specification questions in the application. If your application doesn't ask for your printer's specifications, use the information to reconfigure the printer port by using the Control Panel Program, explained in Chapter 3. If you're sure your printer specifications are right, take your cable to your authorized Apple dealer and make sure it's the right kind.

Problem	Analysis	Solution
Your printer doesn't print, and it's the first time you've tried to print anything with that particular application.	The computer is sending information to the printer in a form the printer can't deal with. You're using either the wrong baud, the wrong number of data bits or stop bits, or the wrong kind of parity.	Check the manual that came with your printer to see how your printer expects to receive data from the computer, and then use that information to answer printer-specification questions in the application. If your application doesn't ask for your printer's specifications, use the information to reconfigure the printer port by using the Control Panel Program, explained in Chapter 3.

Trouble with the modem

Problem	Analysis	Solution
Every character appears twice on the screen when you're sending a message.	Your computer is echoing every character you send on the screen, and the other computer is echoing every character it receives back to your screen.	Change the Echo setting to No by using the Control Panel Program or the communications application.

Problem	Analysis	Solution
A line of meaningless characters appears on the screen when you send or receive messages over phone lines.	The computer on the other end of the phone line is sending information to your computer in a form your computer isn't set up to receive. You're using either incompatible bauds or incompatible data formats (the wrong number of data bits or stop bits, or the wrong kind of parity).	Check the documentation furnished by the information service to see what specifications the other computer is using, and then change the way your computer is set up to exchange information by using your communications application or the Control Panel Program.
Characters are lost during information exchange.	There is too much distortion on the phone lines to transmit information at the speed you're using.	Change to a lower baud, if possible, on both the sending and the receiving end.
Information sent through the modem doesn't appear on your screen.	The other computer isn't echoing information back to your computer. It's a half-duplex modem.	Change the Echo setting to Yes by using the Control Panel Program or the communications application.
Your communications application works with a modem connected to a Super Serial Card, but not with a modem connected to the Apple IIGS modem port. (You've already checked to be sure the port is configured properly by using the Control Panel Program.)	Your communications software is addressing a particular chip on the Super Serial Card.	Use a Super Serial Card or get a communications application designed for the Apple IIGS.

Appendix B

A Technical Introduction to the Apple IIGS

The Apple IIGS is the newest model in the Apple II computer family. It is significantly more powerful than any previous Apple II, with a fast 16-bit processor and 256K of memory, which you can increase by up to 8 megabytes with a memory expansion card.

Compatibility

It is important to remember that the Apple IIGS is an Apple II. This means that most existing Apple II programs and peripheral devices, as well as future programs developed for the Apple IIe and Apple IIc, will work with the Apple IIGS.

Apple II programs and peripherals will run on the Apple IIGS provided they conform to the operating conventions for the Apple II family. Of course, programs or peripheral devices that operate outside those conventions may not run properly on the Apple IIGS. Examples of the latter include programs that make use of undocumented firmware entry points and peripheral devices that don't use the slot-enable signals (I/O Select and Device Select). The reasons will become apparent when you read about the firmware and the expansion slots.

Microprocessor

The 65C816 microprocessor used in the Apple IIGS has an 8-bit mode in which it can emulate a 6502. That is the CPU mode the Apple IIGS uses when it is running in Apple II simulation mode. In Apple II mode, the 65C816 CPU in the Apple IIGS can execute 6502 code at the standard Apple II clock rate, 1 MHz, or at the faster Apple IIGS rate, about 2.8 MHz.

Memory

The first two banks—128K—of the Apple IIGS's programmable memory can be configured the same as the memory in a 128K Apple II.

Main and auxiliary RAM

When the Apple IIGS memory is configured for Apple II simulation, the memory map is the same as that in an Apple IIc or a 128K Apple IIe. The first two 64K banks work like the main and auxiliary banks, complete with language-card spaces, display buffers, and the I/O space at hex $C000.

Applesoft in ROM

Like all other models of the Apple II, the Apple IIGS has Applesoft BASIC in ROM, along with built-in Monitor and I/O routines. Existing Applesoft programs will run the same way on the Apple IIGS as on a 128K Apple II.

Text and graphics

The Apple IIGS has all the standard Apple II text and graphics display modes.

40/80-column text

Like the Apple IIc, the Apple IIGS displays text as either 40 or 80 columns. On RGB color monitors, the Apple IIGS gives the user the option of selecting one of sixteen colors for text, another for the background, and a third for the border of the display. Like earlier models of the Apple II, the Apple IIGS displays text in black and white on composite color monitors, but in addition gives the user the option of selecting white on black, black on white, or different shades of gray on a composite color or monochrome monitor.

Low, high, and double-high resolution

The Apple IIGS includes all the Apple II graphics modes, including 16-color low resolution, 6-color high resolution, and the 16-color double-high resolution available on the Apple IIc and the 128K Apple IIe.

I/O and expansion

The Apple IIGS combines the built-in I/O ports of the Apple IIc and the expansion slots of the Apple IIe. The Control Panel on the Apple IIGS gives the user the ability to set each of the seven slots to operate either as a built-in port or as an expansion slot for a peripheral card.

Serial I/O ports

Like the Apple IIc, the Apple IIGS has two serial I/O ports for use with printers, modems, and other serial I/O devices. The serial ports also support the AppleTalk local-area network.

The Apple IIGS uses an 8530 Serial Communications Controller to drive both serial ports. This IC is different from the 6550 ICs used in the Apple IIc, so applications that deal directly with the I/O hardware on the Apple IIc will not be compatible with the Apple IIGS.

Disk I/O port

The built-in disk port on the Apple IIGS can handle both 5.25-inch and 3.5-inch disk drives. The disk drives are connected in a daisy chain of as many as six drives. There can be up to four 3.5-inch drives and two 5.25-inch drives.

Game port

Existing hand controllers such as game paddles and sketch pads attach via the game port, just as they do on an Apple IIc. New controllers will plug into either the Apple Desktop Bus or the game port.

Expansion slots

Even though the Apple IIGS, like the Apple IIc, has built-in I/O and disk ports, it is like the Apple IIe in having seven expansion slots. The slots are almost identical to the slots in an Apple IIe and can accept most Apple II peripheral cards. (The Inhibit and Sync lines work differently; please refer to the *Apple IIGS Hardware Reference* for more information.)

The Apple IIGS also has a slot for adding a card with up to 8 megabytes of fast RAM, along with optional added ROM. Note that the Apple IIGS does not have the auxiliary slot found on the Apple IIe; the auxiliary memory in the Apple IIGS is built in, like that in the Apple IIc.

New hardware features

The remainder of this appendix describes the differences between the Apple IIGS and the current Apple IIe and Apple IIc. This section lists the major new hardware features. Note that several features are implemented in firmware as well as in hardware—for example, the Apple Desktop Bus. The firmware aspects of those features are described in "New Firmware Features."

16-bit microprocessor

The microprocessor in the Apple IIGS is a 65C816 operating in conjunction with the custom FPI (Fast Processor Interface) chip. The 65C816 is a 16-bit CMOS design based on the venerable 6502. Table B-1 lists its main features.

Table B-1
Features of the 65C816 microprocessor

16-bit accumulator

16-bit X and Y index registers

Relocatable zero page

Relocatable stack

24-bit internal address bus

8-bit data address bank register

8-bit program address bank register

11 new addressing modes

36 new instructions, for a total of 91 (all 256 op codes)

Fast block-move instructions

Ability to emulate 6502 and 65C02 8-bit microprocessors

In the Apple IIGS, the 65C816 can operate in either of two modes: 6502 emulation mode and native mode. In emulation mode, the accumulator and index registers are effectively 8 bits wide, and existing Apple II programs execute just as they do on any other Apple II model. In native mode, the 65C816 not only has 16-bit accumulator and index registers, it also has several new and more powerful addressing modes that take advantage of its 24-bit addressing.

Two clock speeds

The Apple IIGS uses a clock rate of 2.8 MHz. Allocation of a few clock cycles to non-CPU functions reduces the overall operating speed to approximately 2.5 MHz. The Apple IIGS can also run the 65C816 at the normal Apple II clock rate, 1 MHz.

Memory expansion

The minimum memory in the Apple IIGS is 256K. Apple II programs use 128K of that; parts of the other 128K are used by the system. Programs written for the Apple IIGS (that is, programs that run the 65C816 microprocessor in native mode) can use up to about 176K of the 256K.

The Apple IIGS also has a special card slot dedicated to memory expansion. All the RAM on a memory card is available for Apple IIGS application programs that call the Memory Manager.

There are two versions of the memory expansion card for the Apple IIGS. Using presently available 256K RAM chips, a memory expansion card can have up to 1 megabyte of additional RAM. When 1-megabit RAM chips become available in quantity, a memory card can have up to 4 megabytes of RAM. (The Apple IIGS will accept up to 8 megabytes of expansion RAM.) The additional RAM maps into successive 64K banks starting with bank $02, as shown in Figure B-1. In addition to expansion RAM, the memory expansion card can also have up to 1 megabyte of ROM.

Bank numbers

| 00 | 01 | 02 .3F | E0 | E1 | F0...FD FE FF |

128K
Apple II
memory

System
I/O, and
display
memory

Firmware

RAM

ROM
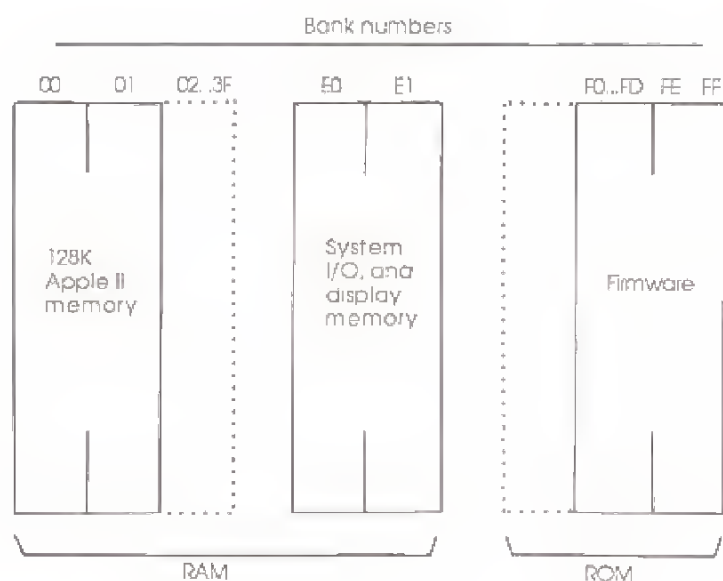
Figure B-1
Memory map

3.5-inch disks and 5.25-inch disks

The Apple IIGS has a built-in disk port like the one on the Apple IIc.
The disk port uses the IWM (Integrated Woz Machine) and can handle up to six drives, connected in a daisy chain. The six drives can include four 3.5-inch drives and two 5.25-inch drives.

Apple Desktop Bus

The Apple Desktop Bus is a simple I/O port with its own micro-processor. Its primary function is to support the detached keyboard and mouse of the Apple IIGS. In addition, it provides a convenient and inexpensive way to connect additional input devices such as hand controls, graphics tablets, and numeric keypads.

Detached keyboard

The Apple IIGS keyboard (available as an option) is the new Apple standard detached keyboard. Without sacrificing any features of the Apple IIe keyboard, the new keyboard layout includes several enhancements, most notably a numeric keypad. The Apple Desktop Bus supports eight different layouts, including the Dvorak or New American Standard Keyboard.

Mouse

An improved AppleMouse™ interface is built into the Apple IIGS. Although the actual hardware is unlike either the Apple IIe card or the Apple IIc, the calling sequences are the same, as required for program compatibility.

The microprocessor in the Apple Desktop Bus keeps track of all mouse movement. Like the AppleMouse card for the Apple IIe (and unlike the mouse interface on the Apple IIc), Apple Desktop Bus operation of the mouse reduces the burden placed on the main processor and makes it possible to have a true passive mode.

Built-in clock

The Apple IIGS has a built-in real-time clock, powered by a long-life battery. You set the clock by means of the Control Panel.

Display

The Apple IIGS has all the standard Apple II video modes, enhanced with colored borders and a choice of colors for text and background. In addition to all that, the Apple IIGS has built-in RGB video and two entirely new graphics modes.

RGB and NTSC video

The Apple IIGS has both RGB and composite (NTSC) video outputs. Either type of display device can be used with the Apple IIGS, although an RGB monitor is required for 80-column text in color. The Apple IIGS's composite video signal is designed for optimum performance with graphics in color or with text in monochrome.

In high-resolution and double high-resolution graphics modes, the appearance of the RGB video display is similar to that of a composite display. (The RGB video from the Apple IIGS is full-analog RGB and is not like the RGB display on the AppleColor 100 Monitor.)

Colored text and border

The standard video modes on the Apple IIGS include two enhancements: colored text and colored borders. The Apple IIGS can display 40- or 80-column text in any of 16 colors, with a background of any other of the same 16 colors. The Apple IIGS can also set the color of the border, that is, the visible part of the display outside the area used for text and graphics.

❖ *Note:* The composite video output switches to monochrome for text modes, making the text, background, and border colors appear as black, white, or shades of gray. This feature reduces color fringing on text displayed on composite color monitors only; the display on an RGB monitor is unaffected.

Super-high-resolution graphics

In addition to all the standard video modes found on the Apple IIc and Apple IIe, the Apple IIGS also has two new super-high-resolution graphics modes. The new modes take advantage of the Apple IIGS's analog RGB video output to produce high-quality high-resolution color graphics.

There are two super-high-resolution graphics display modes:

■ 320 x 200 pixels, 16 colors of 4096

■ 640 x 200 pixels, 4 colors of 4096

Unlike the standard high-resolution and double-high-resolution graphics modes, the new super-high-resolution graphics modes do not sacrifice resolution in order to get color: each pixel has either a 2-bit (4-color mode) or a 4-bit (16-color mode) value associated with it. The pixel values select colors from programmable palettes. Each entry in a palette is a 12-bit value specifying one of 4096 possible colors.

To further increase the number of colors available on the display, there can be as many as 16 different palettes in use at the same time. Each of the 200 horizontal lines of pixels can use any one of the palettes, giving as many as 256 different colors at once. Furthermore, the palette information is easily saved along with the display data so that each picture has its own palettes.

There is also a graphics fill technique whereby the program can cause the display to fill any portion of a horizontal line with a new color, simply by setting marker values on the boundaries of the fill area.

Sound

The standard Apple II sound output consists of a single bit. Programs can produce sounds by switching that bit on and off. Additionally, the Apple IIGS has new sound-generating abilities from a special-purpose sound synthesizer IC made by Ensoniq and used in the Mirage™ music synthesizer. In the Apple IIGS, the Ensoniq IC operates in conjunction with dedicated RAM chips and a custom interface IC, the Sound GLU. The output of the Ensoniq chip is from a digital-to-analog converter that gives the chip the ability to control the volume and waveform of the sound.

With appropriate software, the synthesizer chip in the Apple IIGS will be capable of synthesizing speech.

New firmware features

The Apple IIGS has a total of 128K of built-in firmware. In addition to Applesoft BASIC and the standard Apple II Monitor and I/O features, this built-in firmware supports several major new features.

Control Panel

The Control Panel is a resident utility program. It is always available to the user; the user can invoke the Control Panel even while another program is running. The Control Panel enables the user to specify the operating parameters for the following functions:

- **I/O ports:** printer or modem, line length, baud, and so on
- **Display:** 40/80 columns, text and border colors
- **Sound:** volume and pitch to use for bell
- **Operating speed:** normal or fast
- **Slot allocation:** internal port or peripheral card
- **Language:** character set for keyboard and display
- **Time and date:** for built-in clock
- **RAM disk size:** how much of memory on memory expansion card can be used as a RAM disk

Enhanced Monitor

The Monitor provides machine-language access to the registers and memory. Among the new features of the Apple IIGS's Monitor are:

- Improved display
- Long addresses
- New commands
- Mini-assembler
- Disassembler

Improved display

Memory displays now include both hexadecimal and ASCII values.

Long addresses

The Apple IIGS Monitor supports all the features of the new 65C816 microprocessor, including 16-bit registers and 24-bit addresses.

New commands

The Apple IIGS's Monitor has many new commands. Among them are:

- Save and restore registers and mode settings
- Search memory for a pattern up to 256 bytes long
- Fill part of memory with a 1-byte value
- Make a call to the Tool Locator
- Store a new value in a specified register
- Change the setting of the real-time clock
- Convert hexadecimal to decimal or vice versa
- Perform 16-bit addition and subtraction

Mini-assembler and disassembler

The Apple IIGS Monitor includes a mini-assembler and a disassembler for the 65C816. Both the mini-assembler and the disassembler can handle all 91 of the 65C816's instructions and all 24 addressing modes (a total of 256 op codes). In addition, the disassembler properly expands ProDOS operating-system calls, showing the command number and parameter-list pointer separately.

Full interrupt support

The firmware includes interrupt support for the full range of interrupts possible on the Apple IIGS. Table B-2 shows the types of interrupts.

Table B-2
Interrupts

Program (Break or COP instruction)

Peripheral Card IRQ

Video Vertical Blanking

Video Scan Line

Mouse

AppleTalk Network

Timer for AppleTalk

Keyboard

Serial Input on Port 1

Serial Input on Port 2

Ensoniq (sound) Chip

Clock Chip

Apple Desktop Bus

External Interrupt from Disk (IWM) Port

Power Up

Control Reset

Apple Desktop Bus

The Apple Desktop Bus provides a simple communications interface for the Apple IIGS detached keyboard, mouse, and other similar input devices, such as joysticks and graphics tablets.

The Apple Desktop Bus supports mouse operations in somewhat the same way as the AppleMouse card for the Apple IIe. It provides a true passive mode, enabling the Apple IIGS to support the mouse while running software routines that cannot be interrupted, such as critical timing loops. Like the AppleMouse card, the Apple Desktop Bus also supports interrupt-mode operation of the mouse, waiting until VBL occurs (60 times a second) before interrupting the system.

AppleTalk

The AppleTalk interface is built into the Apple IIGS, unlike the Apple IIe and Apple IIc, which need an optional peripheral device for AppleTalk. Those peripheral devices have dedicated microprocessors to handle the AppleTalk communications chip (SCC), but the Apple IIGS uses its main processor. The interrupt service routine of the Apple IIGS is designed to respond to the SCC in time to preclude data overruns. In addition, a hardware timer generates a system interrupt four times a second to enable the AppleTalk firmware of the Apple IIGS to perform high-level functions.

New software tools

One of the biggest differences between the Apple IIGS and earlier models of the Apple II is that, like the Macintosh, the Apple IIGS has built-in software tools that can be used by applications. These tools make it easier to develop new applications.

The Apple IIGS tools include

- **Desk Manager:** handles desk accessories, which are small shared-memory applications like calculators and calendars.
- **Memory Manager:** controls the use of memory.
- **Tool Locator:** handles communication between applications and tools.
- **QuickDraw II:** a set of graphics routines that support the new super-high-resolution graphics display.
- **Event Manager:** allows your application to monitor actions involving the mouse and the keyboard.
- **SANE Numerics:** a precise implementation of the IEEE Standard (754) arithmetic.
- **Sound Tools:** support for the Apple IIGS sound capabilities.
- **Miscellaneous Tools:** help new applications communicate with low-level firmware.
- **Integer Math:** handles multiplication, division, and conversion of binary to decimal integers.
- **Text Tools:** help applications display text on the text screen and communicate with peripheral cards.

Reference manuals

The following manuals are available, or will be soon, from Addison-Wesley Publishing Company, Inc., at selected bookstores or through your authorized Apple dealer.

Overview

Technical Introduction to the Apple IIGS
Programmer's Introduction to the Apple IIGS

Hardware and firmware

Apple IIGS Hardware Reference
Apple IIGS Firmware Reference

Development environment

Apple IIGS Toolbox Reference: Volume 1
Apple IIGS Toolbox Reference: Volume 2
Apple IIGS Programmer's Workshop Reference
Apple IIGS Workshop Assembler Reference
Apple IIGS Workshop C Reference
ProDOS8 Reference
Apple IIGS ProDOS16 Reference

Related manuals

Apple Human Interface Guidelines
Applesoft BASIC Programmer's Reference
BASIC Programming With ProDOS
Programming the 65C816 by David Eyes and Ron Lichty. New
    York: Brady Communications (a division of Simon & Schuster),
    1986.
The C Programming Language by Brian W. Kernigham and
    Dennis M. Ritchie. Englewood Cliffs, N.J.: Prentice-Hall, 1978.
Apple IIe Technical Reference

*Available from your authorized Apple dealer.

Appendix C

Apple IIGS Pin-Outs

Headphone jack

Pin number	Signal description	Pin number	Signal description
1	Signal ground	3	Ear phone 2
2	Ear phone 1		

Printer and modem ports

Pin number	Signal description	Pin number	Signal description
1	Handshake out	5	Receive data minus
2	Handshake in	6	Transmit data plus
3	Transmit data minus	7	Goes to DCD input on SCC
4	Signal ground	8	Receive data plus

Both serial ports have the same pin-outs.
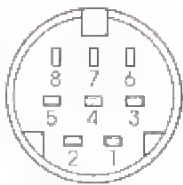
Figure C-1
Printer and modem port pin-outs
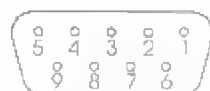
Figure C-2
Game port pin-outs

Game port

Pin number	Signal description	Pin number	Signal description
1	Switch 1—🍏	6	Switch 2
2	+5 volts	7	Switch 0—⌘
3	Signal ground	8	Paddle 1
4	Paddle 2	9	Paddle 3
5	Paddle 0		

The game I/O signals are also available on a 16-pin DIP socket labeled GAME I/O on the main circuit board inside the case. (See Figure C-6.)

Figure C-3
Disk drive port pin-outs

Disk drive port

Pin number	Signal description	Pin number	Signal description
1	Signal ground	11	Seek phase 0
2	Signal ground	12	Seek phase 1
3	Signal ground	13	Seek phase 2
4	3.5-inch disk	14	Seek phase 3
5	−12 volts DC	15	Write request
6	+5 volts DC	16	Head select
7	+12 volts DC	17	Drive 2 enable
8	+12 volts DC	18	Read data
9	Enable 2	19	Write data
10	Write-protect		

Figure C-4
RGB video port pin-outs

RGB video port

Pin number	Signal description	Pin number	Signal description
1	Signal ground (Red)	9	Analog BLUE
2	Analog RED	10	No connection
3	Composite sync	11	Sound 1 volt peak to peak
4	No connection	12	Monochrome video out
5	Analog GREEN	13	Signal ground (Blue)
6	Signal ground (Green)	14	No connection
7	−5 volts DC	15	No connection
8	+12 volts DC	Shield	System ground
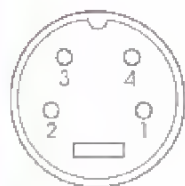
Figure C-5
Apple Desktop Bus pin-outs

Apple Desktop Bus

Pin number	Signal description	Pin number	Signal description
1	Data	3	Power (V+)
2	Reserved	4	Return

Internal speaker

Pin number	Signal description	Pin number	Signal description
1	Positive 1 volt	2	Signal ground
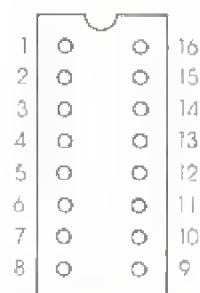
Figure C-6
Internal game connector
pin-outs

Internal game connector

Pin number	Signal description	Pin number	Signal description
1	+5 volts	9	No connection
2	Switch 0—◌	10	Paddle 1
3	Switch 1—◖	11	Paddle 3
4	Switch 2	12	Annunciators
5	Strobe output	13	Annunciators
6	Paddle 0	14	Annunciators
7	Paddle 2	15	Annunciators
8	Signal ground	16	No connection

Index

RGB card 15
RGB color monitor 15, 75
RGB color monitor port 11,
    15
  pin-outs 85
ROM (read-only memory) 4,
    5, 69, 72–73
ROM disk 34–35

S

SANE Numerics 81
saving documents,
    troubleshooting 63
scanning 10, 34
screen *See* display
Screen Colors option 26–27
scroll arrow 53, 55
scroll bar 53, 55
scroll box 53, 55
selecting 44–45
serial interface cards,
    communications
    programs and 12
serial ports *See* modem port;
    printer port
Shift Caps/Lowercase
    option 32
Shift key 32
65C816 microprocessor 4, 5,
    68, 71–72
6502 emulation mode 68, 72
size box 53, 54
slot(s) 9–11, 69–70
  activating 3, 9, 33–34
  ports corresponding to 10
  startup 10
slot 3 11
slot 4 14

slot 5 33, 34
slot 6 33, 34
slot 7 34
Slots command 33
smart port 33
software tools 4, 80–81
sound 4, 77
Sound option 28
Sound Tools 81
Space bar 32
speaker (internal) pin-outs 85
Standard Colors option 27
starting up, trouble-
    shooting 57–58
startup disk drive 3, 13
  changing 34–35
startup slot 10
stop bits 40
super-high-resolution
    graphics mode 4, 76
Super Serial Card, commu-
    nications programs
    and 12
System Bad message 57
System Good message 57
System Speed option 29

T

test, diagnostic 57
text
  editing 48–52
  saving, troubleshooting 63
text mode
  80-column 4, 69, 75
  40-column 69, 75
Text option 27
Text Tools 81
3.5-inch disk drive 3, 13, 33,
    34, 73

title bar 53, 54
Tool Locator 81
tools 4, 80–81
troubleshooting 57–66
  applications 59
  display 61–63
  keyboard 59
  modem 65–66
  mouse 60
  printing 63–65
  saving documents 63
  starting up 57–58
Type option 25

U

UNABLE TO LOAD PRODOS
    message 58
UniDisk 3.5 3, 58
Unlimited line length
    setting 38

V

volume, changing 28

W

windows 53–55
word wraparound 48

X

XON/XOFF setting 37, 41

Y

Your Card message 33

Z

Z80 cards 8